American Machinist

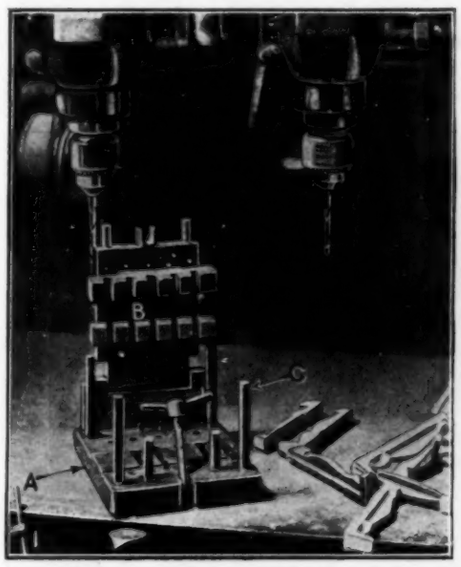
Volume 56 NEW YORK, JUNE 1, 1922 Number 22

Methods in a Radio Shop

Some Devices That Have Been Developed To Handle Small Parts Used in Radio Apparatus —Jigs, Fixtures and a Magazine Feed for an Engraving Machine

By FRED. H. COLVIN
Editor, *American Machinist*

THE devices illustrated herewith have been developed by the Acme Apparatus Co., Cambridge, Mass., for the rapid handling of small parts used in radio apparatus. A drilling jig for transformer frames is shown in Fig. 1. Five of the side bars shown piled on the bench are held between the pins shown in the baseplate *A*. The lid *B* is closed over the bars and is clamped by the screw shown. The bushings are carried in the plate and the jig is then turned upside down, resting on the feet *C*, so that the holes are all drilled from the flat sides of the bars. These bars are of aluminum and it is, of course, necessary to clean the jig between each loading, so as to insure the next pieces fitting evenly on the plate *A*. The operator found that by dipping the empty jig in a pail of gasoline, the chips were removed instantly.



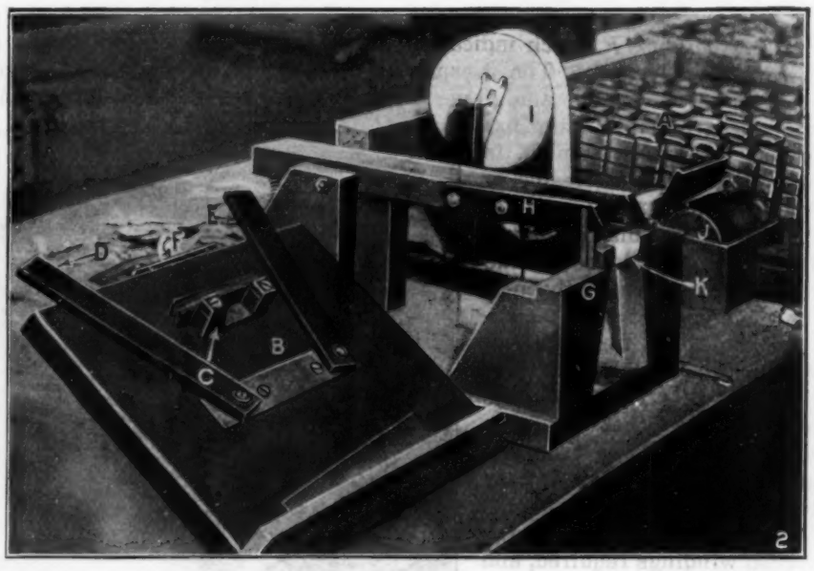


FIG. 1—DRILLING THE TRANSFORMER FRAME. FIG. 2.—ASSEMBLING KEEPERS FOR TRANSFORMER CORES

The cores for the transformers consist of a stack of U-shaped stampings, some of the assembled ones being shown at *A* in Fig. 2. The flat keepers that are placed over the ends of the cores are assembled in the fixture

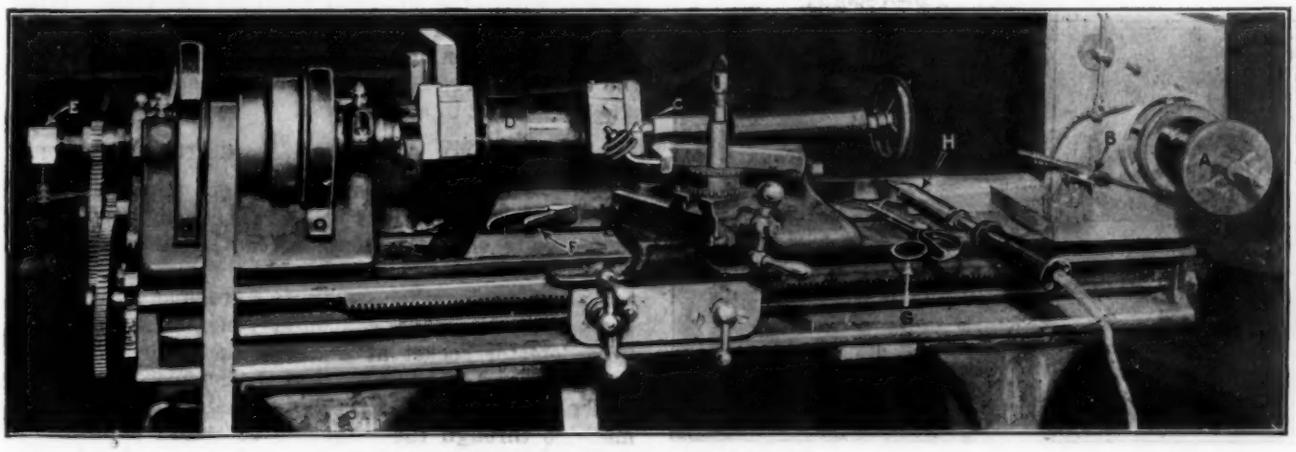


FIG. 3—WINDING SPECIAL COILS

shown at *B*. The required number of strips are laid on the two-pronged block, as at *C*, and the two arms *D* and *E* are brought together until they stop against the

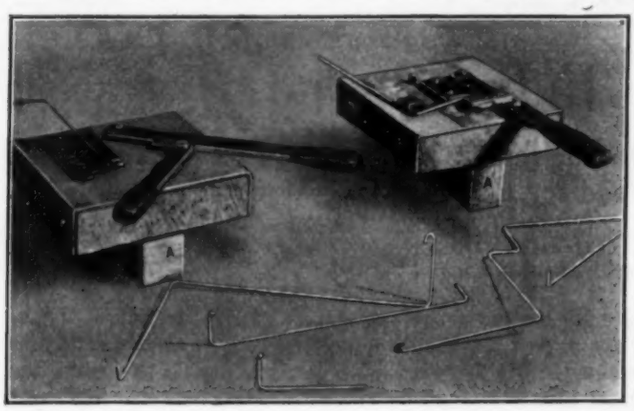


FIG. 4—BENDING FIXTURES FOR CONNECTING WIRES

ends of the plate *F* which indicates that the strips are in a central position. The package is then picked up by placing the thumb and finger between the prongs and placed in the binding fixture *G* while the arm *H* is brought down by a treadle to hold it in place until it is secured by the insulating paper. This paper is carried on the roll *I* and is threaded through the moistener at *J*. A sufficient length is torn off and wrapped around the center of the stack of strips at *K*. It will be noted that the open construction of the frame *G* and the arm *H* makes it easy to bind the strips.

An idea of some of the special windings required, and the method of doing the work may be had from Fig. 3. The lathe is fitted with a special chuck for holding the cores to be wound. The wire comes from the spool *A* which is kept under the proper tension by the spring controlled brake *B*. The wire is fed around the grooved roller *C* and onto the cores as at *D*. The counter *E* enables the operator to keep track of the number of turns in the coil, which is very important in this work. The wire cutter *F*, the shears *G* and the electric soldering iron *H* complete the necessary paraphernalia for this work.

Simple Bending Forms

Simple fixtures for bending some of the various connecting wires are shown in Fig. 4. They are made up of wooden blocks designed to be easily clamped in a vise by the tongues *A*, and are provided with sheet metal faces on which are mounted various bending levers and forms, as shown. The fixtures shown are only two of many different fixtures of this kind. Some of the wires bent to various shapes may be seen on the bench in front of the fixtures.

The device shown in Fig. 5 is a magazine feed for a Gorton engraving machine. The plates to be engraved are of standard insulating material and are stacked in the magazine at *A* and fed upward by the weighted chain *B*. The lever *C*, when in the position shown in the illustration, acts as a stop to prevent the upward feed of the pieces in the magazine. When it is moved from the stop position, it allows the pieces to rise,

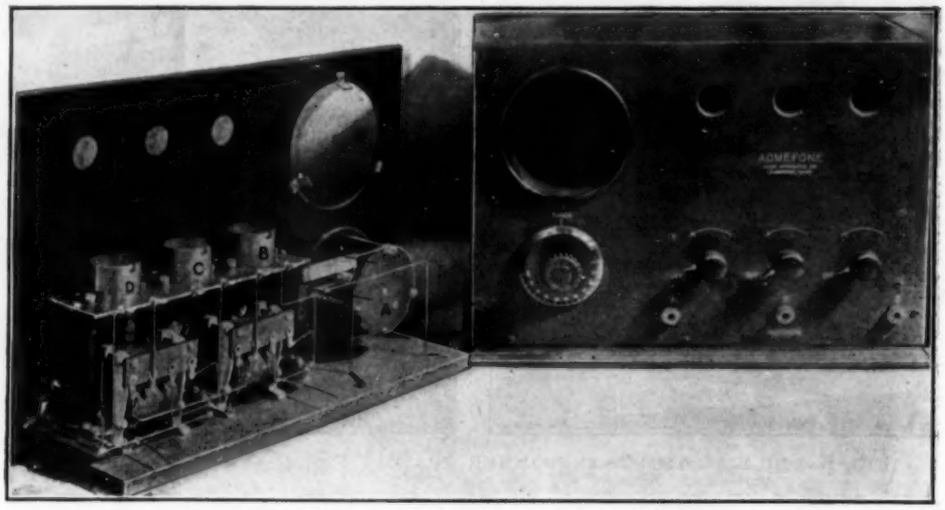


FIG. 6—COMPLETE APPARATUS AND ASSEMBLY

and when moved back to the stop position it pushes the top piece under the plate *D* and brings it into position so that the engraving will be done in the proper location and also pushes the last piece engraved from under the plate *D* and to the left away from the magazine. When the table is full of pieces that have been engraved each successive motion of the lever *C* pushes off the piece at the extreme left of the table from where it drops into a chute leading to a receptacle.

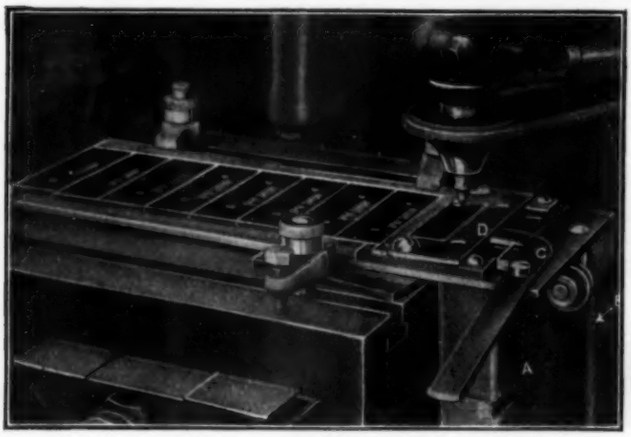


FIG. 5—A MAGAZINE FEED FOR AN ENGRAVING MACHINE

The Assembled Apparatus

Some idea of the appearance of the assembled apparatus is given in Fig. 6. The completed transformers are shown in place at the left, together with some of the connecting wires and the manner in which the parts go together. This is a complete little unit, comprising a variable condenser tuner at *A*, an audion tube detector socket at *B* and sockets for amplifying bulbs at *C* and *D*. The front of the complete box, shown at the right, is one of the pieces fed to the engraving machine through the magazine described above. The engraving consists of lettering and arrows showing the direction in which to turn the various control knobs.

Estimating Modern Gear Production

Charts and a Slide Rule That Make Estimating Easy—Use of Disk Cutters and Hobs—Extra Travel of Cutters—Examples of Estimate Sheets

By GUSTAVE E. SPIES
Estimator, Gould & Eberhardt

THE increased productivity obtained from modern machines has created a demand for a means to easily and accurately calculate such production.

An estimating operation should be applicable to a given set of operating conditions, the method being such that the required result is obtained by means of purely mechanical operations on the part of the person doing the estimating, necessitating little or no mental effect.

A series of charts has been developed in the factory of Gould & Eberhardt, Newark, N. J., for rapidly and accurately calculating the rate of production on gear cutting machines. The charts, which are presented herewith and fully described, are especially adapted for both the hobbing and disk-cutter type machines manufactured by Gould & Eberhardt. A slide rule for the same purpose is also shown and described. which has various advantages over the charts mentioned, particularly in expediting the calculations.

Many factors affect the accurate calculation of gear production, each of which must be given careful consideration. The chief factor is the proper selection of the most suitable method, type of machine for the required output, style, finish and accuracy of the gear.

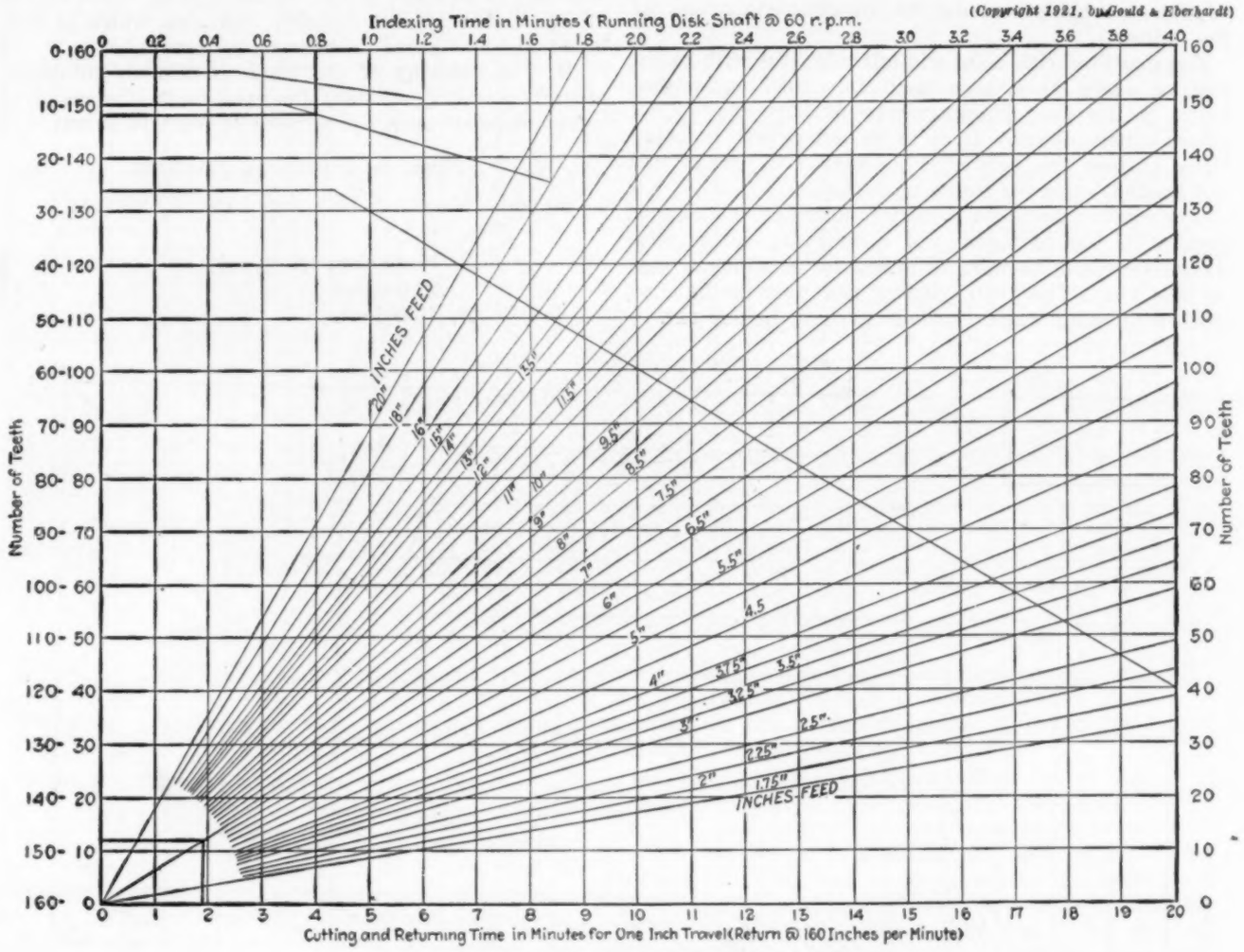


FIG. 1. CHART FOR DISK-CUTTER TYPE MACHINES

Knowing this the following factors, relative to machining, are then to be considered.

Using Disk Cutters

First—When a disk-cutter type machine is selected:

A, Style of cutters.
B, Work support
C, Feed and return of cutter
D, Indexing of blank.

A. Cutters are of great importance in obtaining the best results. Great care should be taken in their selection and consideration should be given to the following items:

Whether the quality required is such that roughing

and finishing cutters are necessary.

Whether the quality required will permit finishing in one cut.

Whether two or more teeth can be finished simultaneously.

Whether one tooth can be finished with a roughing and finishing cutter in gang.

For roughing gears of 3-pitch and finer, cutters with right and left rake and hooked cutting faces can be used to advantage both singly and in gangs. When used in gangs, the cutters should be arranged in herring-bone style, that is, the inner edges of the cutting teeth on the two cutters should cut simultaneously and then the outer edges of the succeeding teeth and so on alternately, thereby counteracting any oscillating effect of the gear being cut, due to the alternate action of the cutters.

Gang cutters with right and left rake, but with radial cutting edges have been used for finishing several teeth in the gear blanks where quality was not of prime consideration. It is to be noted that in using these cutters the cutting edge should be radial and not hooked, as in the roughing cutter.

For coarser pitches a roughing cutter of the stepped type with hooked faces, and a finishing cutter with radial faces can be used in gangs for finishing a gear in one cut. The finer pitches can also be finished, with a finishing cutter radially ground, in one cut.

For the highest class of gears, it is advisable to rough out the gear with a single or gang roughing cutter, and then finish it in a separate operation with a radially ground finishing cutter.

B. The work support should be of very rigid design so as to eliminate the tendency for the machine to chatter. It has been found that the work support is a very important factor, in both output and finish of gear cutting machines. The elimination of chatter also increases the life of the cutter, by reducing the number of sharpenings of the cutting edge to a minimum.

C. The feed of the cutter in inches per minute must be selected with particular regard to the quality of finish desired and to maintain the proper form of tooth. The kind of material to be cut also controls the feed as well as the style of cutter used. The return of the cutter is an automatic operation which is constant and is figured in inches per minute.

D. The indexing of the blank is also an automatic operation and is constant for each tooth, the speed of which depends upon the number of teeth to be cut.

Work on a Hobbing Machine

Second—When a hobbing machine is selected:

A, Hob
B, Work support
C, Hob speed
D, Hob feed.

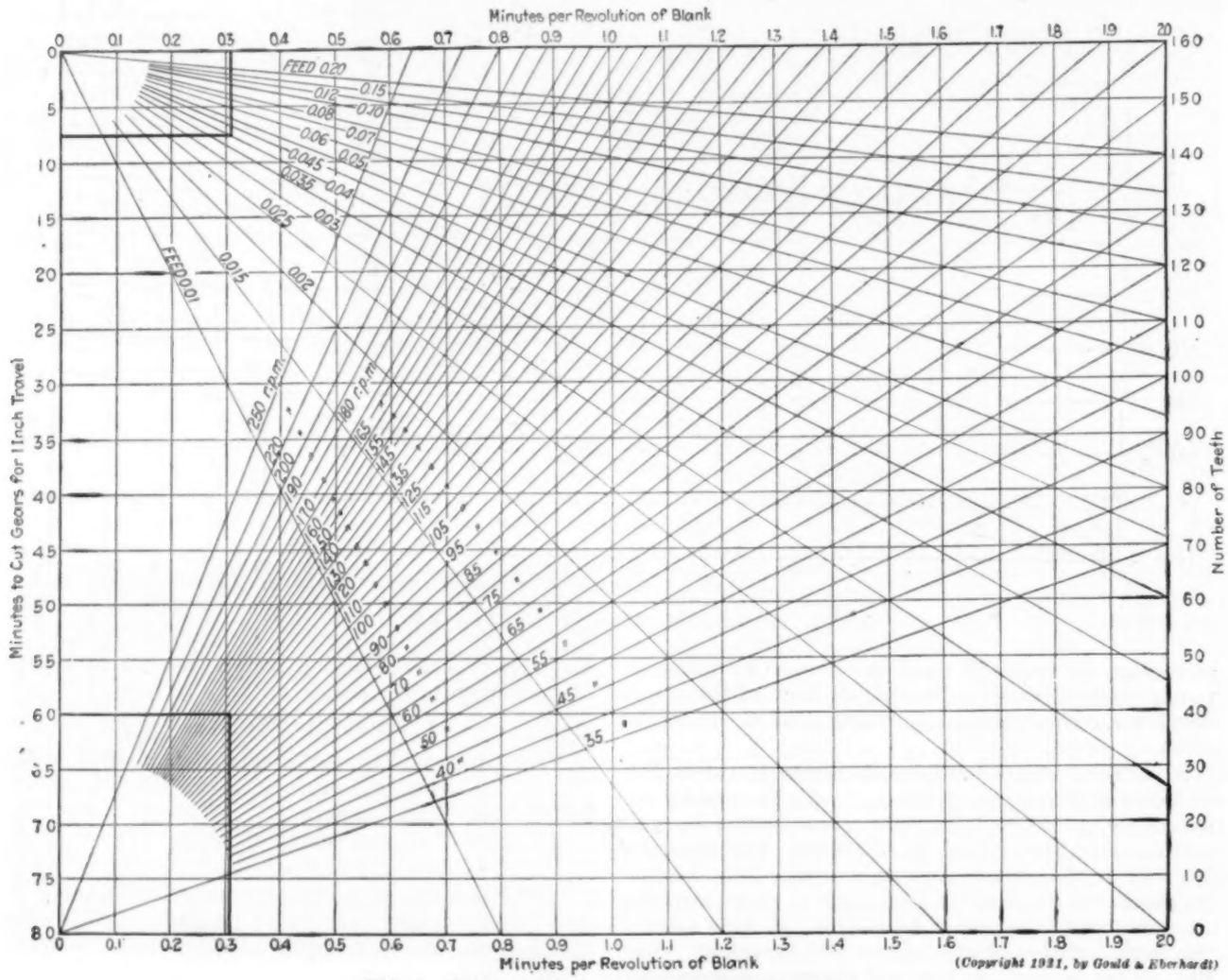


FIG. 2. CHART FOR GEAR HOBBING MACHINES

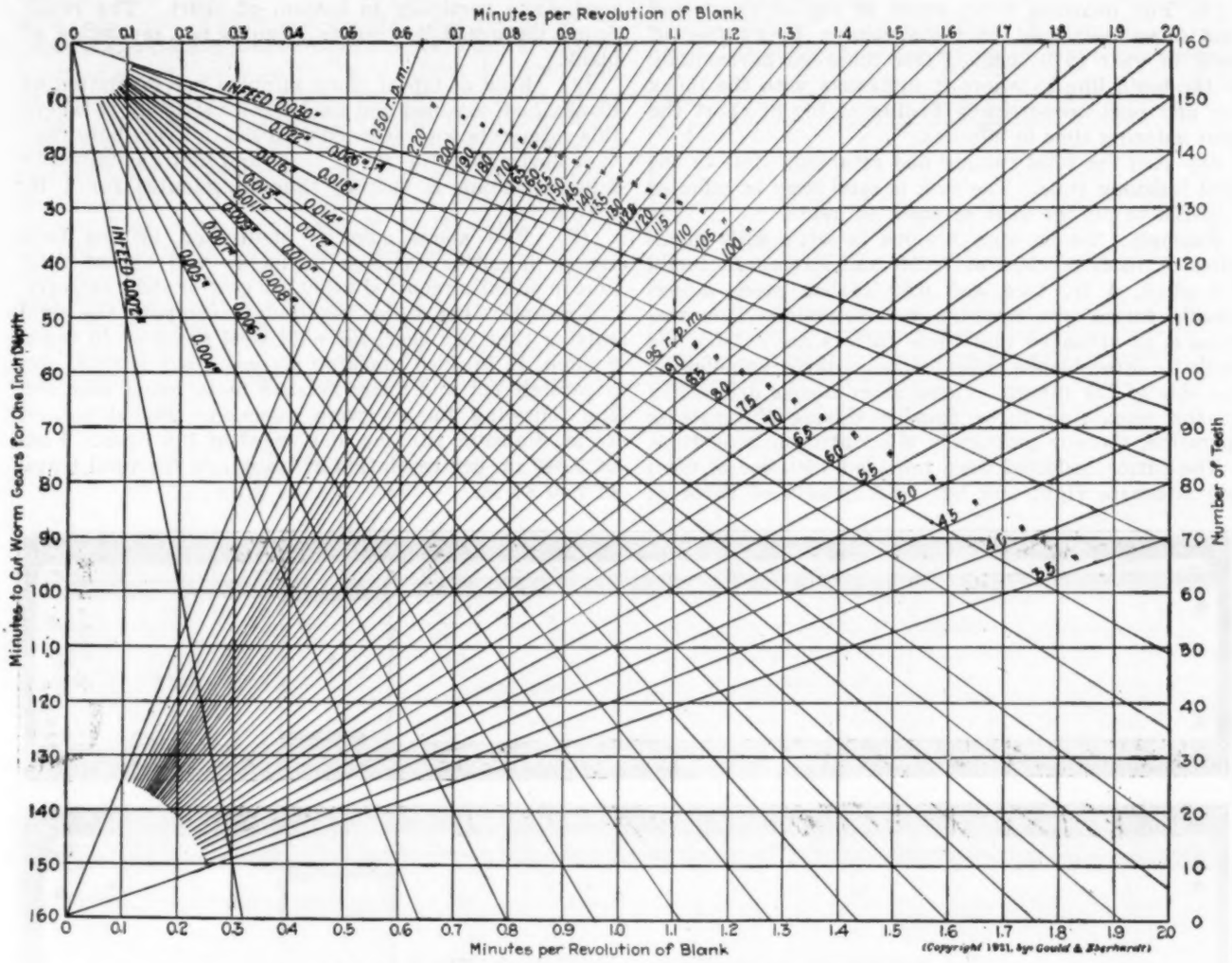

Minutes per Revolution of Blank
Minutes to Cut Worm Gears for One Inch Depth
Number of Teeth
Minutes per Revolution of Blank
(Copyright 1921, by Gould & Eberhardt)

FIG. 3. CHART FOR WORM-WHEEL HOBBING MACHINES

A. The selection of the hob rests upon the following considerations:

Whether a roughing and finishing hob is to be used.
Whether or not the quality of finish is such that only one cut need be taken.

It has also been found advantageous, when roughing with hobs that they be made with hooked cutting faces, instead of radial cutting faces. Also that the roughing hob must be made thinner than the finishing hob. For accurately forming the teeth a radially ground hob should be used.

For commercial purposes spur gears and helical gears can be finished in one cut. For gears of higher quality it is generally advisable in cases of 3-pitch and coarser to take two cuts, one roughing and one finishing.

B. The work support must be of still more rigid design than that used on disk-cutter machines. The rim of the blank must be supported near the periphery. Very substantial clamping means should be applied because of a certain amount of tangential pressure that is put on the gear while being cut. When cutting helical gears of extreme angles it is often advisable to have keyways in the gear and in the work arbor.

C. The speed in feet per minute of the hob depends entirely upon the material to be cut and the number of sharpenings determined upon as being the most economical for a given period of time or output.

In hobbing gears, the speed of the hob, or rather its revolutions are an important factor in the output. In this respect hobbing is distinguishable from disk cutting, in which the revolutions of the cutter do not directly effect the output.

D. The feed of the hob in inches per revolution of the gear blank depends upon the finish required. It is not greatly affected by the material to be cut.

The practice as outlined, having been carefully considered, the next step is to determine the limitations of the machine, that is to say the number of blanks which can be stacked, having due regard for the fact that the blanks should be removed without disturbing centers. The estimator is then ready to proceed with the actual calculation of the output.

Jsing Chart for Disk Cutter Estimating

In Fig. 1 is illustrated a rectilinear chart especially designed for gear cutting machines of the disk cutter type. The factors having been determined as outlined, this chart is used as follows:

(1) Enter at the origin of chart and read up vertically on the tooth column to number of teeth in gear to be cut. From there go horizontally on the tooth line to where it intersects with the selected feed line, and read down vertically finding at bottom of chart the cutting and returning time of gear for 1 in. travel.

(2) Multiply this number by the total travel of cutter, and the product or result is total cutting and returning time, in minutes.

(3) For indexing time, enter at top of chart and read down vertically on tooth column to number of teeth in gear to be cut. From there go horizontally on the tooth line to where it intersects with the index line and read up vertically finding at top of chart the total indexing time in minutes.

(4) Add the total cutting and returning time to the total indexing time. The sum is total time in minutes required to cut the gear or stack of gears.

Example: To cut spur pinions in large daily quantities of medium class of finish and having 12 teeth, 3-4 pitch, 4 in. face and 0.50 carbon steel, a six-spindle turret-type machine was selected. This machine is so arranged that three cutters are cutting the teeth in three blanks mounted upon three spindles on one side of the turret. Three other blanks are loaded on the remaining three spindles during the cutting operation, thereby practically eliminating setting time.

The cutters selected were provided with radial faces and alternate right and left rake in sets of three of uniform diameter. The feed of cutter carriage per minute selected was 6.5 in. The total travel of cutter in this case is 5¾ in. using cutters of 4¾ in. diameter and having an extra travel of 1¾ in.

(The extra travel for cutters and hobs can be readily obtained from Fig. 5 which also indicates proper diameters for the various pitches.)

(1) Cutting and returning time in minutes for 1 in. travel (return at 160 in. per minute) = 1.95 min.

(2) 1.95 min. x 5¾ in. total travel = 11.03 min.

(3) Indexing time for 12 teeth = 0.8 min.

(4) Total cutting time 11.83 min.

The total time, 11.83 min., is for three pinions to which is added setting time of 0.5 min. for rotating turret and starting cut on three other blanks.

In Fig. 2 is shown a rectilinear chart adapted for spur and helical gear hobbing-machines. The factors having been determined as outlined above, the chart is used in the following manner:

(1) Enter at the origin of chart and read up vertically on tooth column to the number of teeth in gear to be cut. Then read over horizontally on tooth line to where it intersects with r.p.m. line (speed of hob) and read down vertically to bottom of chart. The result found there will be time in minutes per revolution of blank.

(2) Find at top of chart minutes per revolution of blanks just obtained and read down vertically to where this intersects with selected feed line. From here read over horizontally to left of chart and figure obtained in minute column is cutting time in minutes for 1 in. travel.

(3) The above quantity multiplied by the total travel of cutter carriage in inches will be the total time in minutes required to cut the gear or stack of gears.

Example: Let it be required to compute the total cutting time per gear, for mild steel gears of 40 teeth, 8 pitch, 1¼ in. face, stacking six gears per setting. An accurately cut and finely finished tooth being required, the following factors were assumed. Radial hob of 2⅞ in. diameter running at a speed of 130 r.p.m. Feed of 0.040 in. per revolution of blank and the total travel of hob 8½ in.

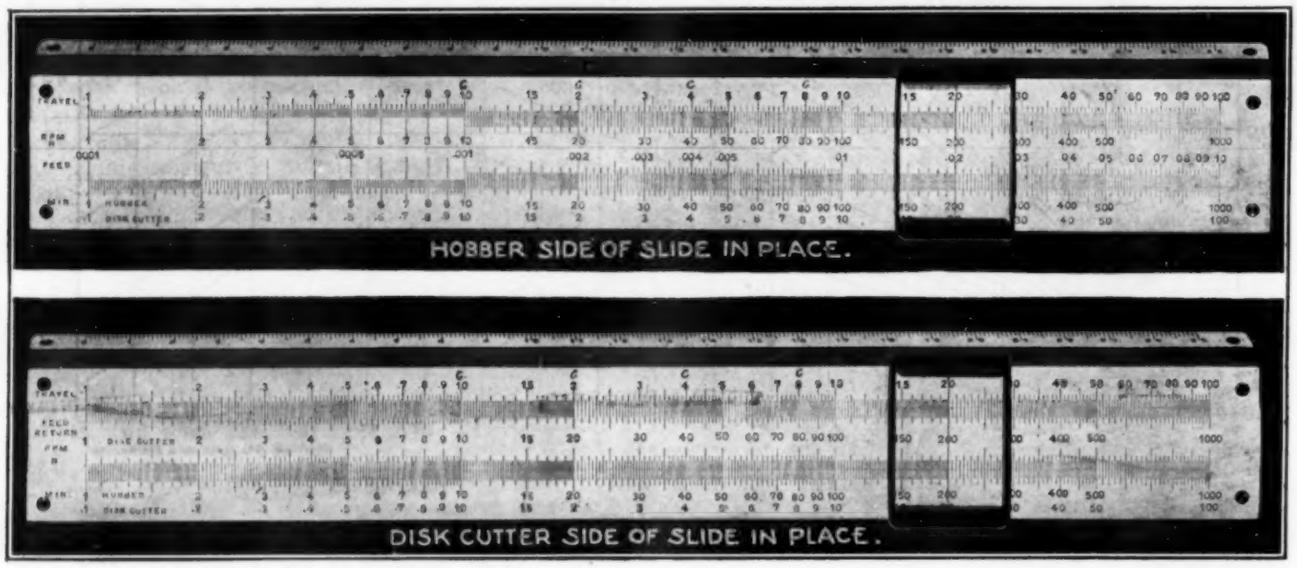


FIG. 4. SLIDE RULE FOR HOBBING AND DISK-CUTTER TYPE MACHINES

The following results were obtained by using the chart:

(1) Time per revolution of blank = 0.31 min.

(2) Time for 1 in. travel = 7.7 min.

(3) 7.7 min. per inch x 8½ in. total travel = 65.4 min. = cutting time for six gears.

In Fig. 3 is shown a chart used for computing the necessary time to hob worm wheels by the "infeeding" method. As this chart is analogous to the hobbing chart just described, its use need not be explained in detail.

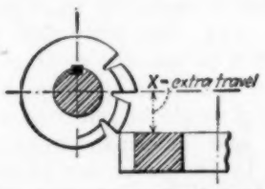
Charts similar to those shown in Figs. 2 and 3 can be prepared for calculating output on worm-wheel hobbing machines equipped with tangential feed. Different feed values in this case must be substituted for the feed values shown in Fig. 2. These values depend upon whether a tangential feeding hob or a fly tool is used. For the latter, smaller feed values are inserted. The method of using this chart is identical with that described in spur and helical gear hobbing.

In Fig. 4 is illustrated a slide rule developed by the writer for computing the problems solved by the charts just described. This slide rule being less cumbersome and combining in one instrument the essential elements of several charts, is far superior for quick work. In

common with other slide rules it consists substantially of a body with a slide and runner. All the scales on this rule, including the reverse side of slide, are graduated logarithmically with three cycles between the indexes. The slide as illustrated has two sides graduated, one for hobbing and the other for disk-cutting time computations. The four gage points marked *C* on travel scale represent constants which vary according to the number of teeth being cut on a disk cutter machine. They indicate the number of revolutions made by the disk shaft in indexing one tooth. Their use will be explained later. The scales have certain markings which are thus explained.

Travel = Total travel of hob or cutter.

The scale marked "MIN." has two values, an upper and a lower. The upper value indicates in minutes the total cutting time for hobbing, and the lower value has a triple significance, namely, cutting time in minutes, total returning time in minutes, and total indexing time in minutes for a disk cutting machine.



CUTTERS									HOBS							
HOLE	1 1/4		1 1/2 •		1 1/2		2 •		HOLE	1 1/4		1 1/2		2		
KEYWAY	3/16 x 5/32		5/8 x 5/16		5/8 x 5/16		1/2 x 3/16		KEYWAY	5/16 x 5/32		5/8 x 5/16		1/2 x 1/4		
PITCH	DIAM.	X	DIAM.	X	DIAM.	X	DIAM.	X	PITCH	DIAM.	X	DIAM.	X	DIAM.	X	
1 1/2					7 1/4	3 1/8			1 1/2					7 1/2	3 1/4	
1 3/4					6 3/4	2 7/8			1 3/4					7 1/4	3 1/8	
2					6 1/4	2 5/8			2			5 3/4	2 1/2			
2 1/4					6 1/2	2 3/4			2 1/4			5 1/2	2 3/8			
2 1/2					6 1/2	2 3/8	5 3/4	2 1/4	2 1/2			5	2 1/8			
2 3/4					6 1/4	2 1/4	5 1/2	2 1/8	2 3/4			4 3/4	2			
3	4 1/2	1 7/8			5 1/2	2	5 1/2	2 1/8	3	4 1/2	1 7/8					
3-4	4 1/2	1 3/4	4 1/2	1 3/4	5 1/4	1 7/8	5 1/2	1 7/8	3 1/2	4 3/8	1 3/4					
3 1/2	4	1 3/4	4 1/2	1 3/4	5 1/4	1 7/8	5 1/2	1 7/8	4	3 7/8	1 3/4					
4	4	1 7/8	4 1/2	1 7/8	5 1/4	1 7/8	5 1/2	1 7/8	3-4	3 1/2	1 3/4					
4-5	4	1 7/8	4 1/2	1 7/8	5 1/2	1 7/8	5 1/2	1 7/8	5	3 1/2	1 3/4					
5	3 1/2	1 7/8	4 1/2	1 7/8	5 1/2	1 7/8	5 1/2	1 7/8	4-5	3 1/2	1 3/4					
5-7	3 1/2	1 7/8	4 1/2	1 7/8	5 1/2	1 7/8	5 1/2	1 7/8	6	3 1/4	1 3/4					
6	3 1/2	1 3/4	4 1/2	1 7/8	4 1/2	1 7/8	5 1/2	1 7/8	7	3	1 7/8					
6-8	3 1/2	1 7/8	4 1/2	1 3/4	4 1/2	1 7/8	5 1/2	1 7/8	5-7	3	1 7/8					
7	3 1/2	1 7/8	4	1 3/4	4 1/2	1 7/8	4 1/2	1 7/8	8	2 7/8	1					
7-9	3 1/2	1 7/8	4	1 7/8	4 1/2	1 7/8	4 1/2	1 7/8	6-8	2 7/8	1					
8	3 1/2	1 7/8	4	1 7/8	4 1/2	1 7/8	4 1/2	1 7/8	9	2 3/4						
8-10	3 1/2	1	4	1 7/8	4 1/2	1 7/8	4 1/2	1 7/8	7-9	2 3/4						
9	3 1/2	1 7/8	3 7/8	1 7/8	4 1/2	1 7/8	4 1/2	1 7/8	10	2 3/4						
10	3 1/2	1	3 7/8	1 7/8	4 1/2	1 7/8	4 1/2	1 7/8	8-10	2 3/4						
12	3 1/2	7/8	3 1/2	1 7/8	4 1/2	1	4 1/2	1 7/8	12	2 1/2						
14									14	2 1/2						

• *Special cutters for multiple spindle machines*

FIG. 5. TABLE OF EXTRA TRAVEL FOR CUTTERS

Scale Markings on Hobber Side

On the side of the slide marked Hobber the scale markings denote the following:

r.p.m. = Revolutions per minute of hob

N = Number of teeth in gear to be cut

Feed = Vertical feed for spur or helical gears and tangential or infeed for worm wheels per revolution of blank.

On the side of the slide marked Disk Cutter the scale markings indicate the following:

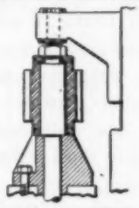
Feed = Feed of cutter in inches per minute

Return = Return of cutter in inches per minute

N = Number of teeth in gear to be cut

DRAWING NUMBER AM-10	PART NAME Pinion	DATE 10-10-21	NUMBER 2708
NUMBER TEETH 12	PITCH 3-4	FACE 4"	AGENT J. P. Jones Mach. Co.
STYLE Spur	MATERIAL 0.50 Carbon Steel	CUSTOMER Smith Tractor Co.	
FEED 6.5"	SPEED 100 Ft.	MACHINE No. 36 S.T. (3 Spindles Cutting) (3 Spindles Loading)	

FIXTURES



CUTTER				TIME	
DIAM.	HOLE	KEYWAY	WIDTH	CUTTING	SETTING
4 3/4"	1 1/4"	1/4" x 1/16"	0.96	11.8 min	0.5 min.
Use cutters with R. and L. rake and radial edge. In sets of three				TOTAL 12.3 min.	EACH 4.1 min.
REMARKS				OUTPUT PER HOUR AT 80 PER CENT EFFICIENCY	OUTPUT PER HOUR OF 8 HOURS
Use 3 spindles, 1 gear each. Total 3 gears. Finish 1 cut				11.7 gears	93.6 gears
				NUMBER MACHINES REQUIRED TO CUT GEARS PER DAY	

FIG. 6. ESTIMATE SHEET FOR GEARS CUT WITH DISK CUTTERS

r.p.m. = Revolutions per minute of disk shaft for indexing.

The table below denotes the constants *C* to be used for different numbers of teeth.

N	*C*
4 — 9	8
10 — 25	4
26 and up	2

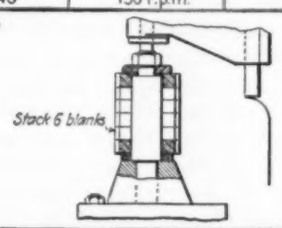
On some machines *C* has a constant value of 1 for all numbers of teeth. This value will not be used in this article.

Using the notation given above for disk-cutter machines, the basic formula for the computation of output follows:

$$\text{Minutes to cut gears} = \frac{TN}{F} + \frac{TN}{R} + \frac{NC}{r.p.m}$$

DRAWING NUMBER J-590	PART NAME Gear	DATE 10-10-21	NUMBER 2700
NUMBER TEETH 40	PITCH 8 PD	FACE 1 1/4"	AGENT F. B. Franklin Co.
STYLE Spur	MATERIAL Steel	CUSTOMER J. P. Brown Mfg. Co.	
FEED 0.040"	SPEED 130 r.p.m.	MACHINE No. 18 H	

FIXTURES



CUTTER				TIME	
DIAM.	HOLE	KEYWAY	WIDTH	CUTTING	SETTING
2 7/8"	1 1/4"	5/16" x 5/32"		65.4 min.	6 min.
Use radial hob				TOTAL 71.4 min.	EACH 11.9 min.
REMARKS				OUTPUT PER HOUR AT 80 PER CENT EFFICIENCY	OUTPUT PER DAY OF 8 HOURS
Cut 6 gears per setting. Finish 1 cut				4.* gears	32* gears
				NUMBER MACHINES REQUIRED TO CUT GEARS PER DAY	

FIG. 7. ESTIMATE SHEET FOR GEARS CUT BY HOBBING

The solution of the production problem used in connection with the chart for disk-cutter machines with the slide rule is given below.

(1) Set slide so 6¼ in. on feed scale is under 5¾ in. on travel scale. Then move runner so hairline coincides with 12 on *N* scale, and on same hairline read on Min. scale for disk cutter, 10.6 min. cutting time.

(2) Set slide so 160 in. on return scale is under 5¾ in. on travel scale. Then move runner so hairline coincides with 12 on *N* scale, and on same hairline read on Min. scale for disk cutter 0.43 min. returning time.

(3) Set slide so 60 on r.p.m. scale is under constant 4 on travel scale. Then move runner so hairline coincides with 12 on *N* scale and on same hairline read on Min. scale for disk cutter 0.8 min. indexing time.

(4) Add the three results together and their sum is equal to 11.83 min., total cutting time for three gears.

An Estimate Sheet For Recording Computations

In Fig. 6 is illustrated an estimate sheet upon which production computations are recorded. The particular sheet shown has the result of the example just solved thereon.

Making use of the notations already given for hobbing machines, the fundamental formula for computing the probable output follows:

$$\text{Minutes to cut gears} = \frac{T}{r.p.m.} \times \frac{N}{F}$$

The problem used in connection with the hobbing machine chart will be solved by means of the rule, in the manner given below.

(1) Set slide so 130 on r.p.m. scale is under 8.5 in. on travel scale. Then move runner so hairline coincides with 40 on *N* scale.

(2) Reset slide so 0.04 on feed scale coincides with hairline on runner and under index on Min. scale for hobbers, read 65.4 minutes. total cutting time for six gears.

In Fig. 7 is shown an estimate sheet similar to that illustrated in Fig. 6 on which the result of the above example has been recorded.

With most gear cutting operations the setting time is largely dependent upon the type of machinery, the size and shape of the blank and the skill of the operator.

The Main Issue

By Entropy

It has often been said, and with much truth, that the principal object of manufacturers is to make money rather than to make any particular product. In the same way it may be said that every department of a manufacturing concern should be so conducted as to make the greatest net profits, always taking into account the permanency of the business and having due regard for the ethics of trade.

Every little while business is subject to fads that for the time obscure the main issue and which produce remarkable showings for certain departments, without always adding to the net profits. We have had attacks of cost systemitis, of planningitis, of Taylorism, and now we appear to be due for an attack of salesitis. Cost systemitis ran its course until it was discovered that it was important to cut down the cost of all parts of the product, and not merely those to which the cost system in vogue at the moment pointed a finger. Planningitis is still in full sway and will run until experience has shown just where it is profitable and where it is not. Taylorism ran until people became weary of hearing the word efficiency, and has since survived under other names and is at present applied in a less wholesale way.

The new thing, salesitis, briefly is a call to cut down cost of sales, ostensibly to enable this country to get its prices for manufactured goods down where they can be bought by those who need them, really to enable this country to pay a higher rate of wages than before the war and thus preserve a purchasing power that will enable us to live on our own market if we do not get the foreign business that we would like.

The Cost of Super-Service

We are told that it costs too much money to sell us things which we need. We reply that we do not want so much persuasion as we are getting, that we would rather buy as we wish than to have things sold to us. The ideal condition would be one where all advertising was educational and salesmen were merely demonstrators called in by the purchaser to confirm the statements made in the advertisement.

Those of us who make up our minds as to what we want and go after it rather than sit back and wait for salesmen to approach us, want to know why we do not get the cash and carry prices that we are becoming used to in the grocery trade. We feel that having a dozen agents spend ten dollars worth of time each and twenty dollars for traveling expenses to come and try to sell us a hundred dollars worth of goods means an expense that is unjustifiable; and we further are very certain that we are called on to pay for this superservice when we do buy, and that we are paying for similar service every time we buy. Yet we see no way to depart from the present custom. If we do go and buy without cost to the seller we get no rebate and hardly any thanks. So very naturally, seeing that we save nothing by doing otherwise we lie back, even though we know just what we are going to buy, and see agent after agent until the right one comes along and thus we experience that luxurious feeling that comes from being waited on. Being waited on is not only luxurious but it is enervating. Kept up long enough it renders us unable to wait on ourselves.

Without any desire to belittle the importance of getting at some plan to reduce all our selling to the self-service or automatic cafeteria plan, there does seem a danger that we may overlook the proper balance of total cost to total income. If we are to engage in any kind of manufacture the first thing to be accomplished is low cost of manufacture; and low cost of manufacture is first of all made possible by so designing the product that it can be made with the minimum of skilled labor, the least overhead charge, and yet fully meet the legitimate needs of the purchaser.

This last, the needs of the buyer, may, however, include much that is not utilitarian—it may include really artistic qualities as well as usefulness—but no matter what it includes, simplicity of manufacture should be kept in mind because it is just there, on the drawing board, that the greatest possible savings in total cost can be made. Let us not forget the main issue: Can we design so that low cost production can be assured and yet produce a useful product that appeals to the practical and so far as is necessary to the aesthetic side of the purchaser?

Properties of Aluminum Alloys

Why These Alloys Make Good Castings—Saving in Cost Shown in Relative Weights—Advantages of Melting Range, Thermal Conductivity, Rigidity and Shrinkage

FROM SALES DEPARTMENT CONDENSED DATA PREPARED BY THE TECHNICAL DEPARTMENT, ALUMINUM COMPANY OF AMERICA

FOR castings of low cost, or intended to meet special conditions, a comparison of physical properties indicates that aluminum alloys are often superior to other metals more commonly used. These alloys possess a decidedly low density, a shrinkage less than those of brass or steel and a thermal conductivity higher than that of iron. To attain the same rigidity as a cast-iron beam, a No. 12 alloy beam must be only half as heavy. Aluminum is therefore the better metal to use where low weight is the important consideration.

The low density of aluminum is one of the principal reasons for its extensive use. Iron, steel, brass, bronze, copper, zinc, lead, tin and nickel are all heavier metals. With the exception of magnesium, all the common metals used for casting purposes are from two to three times as heavy as No. 12 alloy. To compare the true cost of any of these heavier metals with that of aluminum, the price of the heavier metal should be multiplied by a factor representing the number of times the weight of a certain volume of the heavier metal is heavier than the weight of the same volume of aluminum. For example, if the price of copper is to be compared with the price of No. 12 alloy it must first be multiplied by 3.11, the factor of copper which represents the number of times copper is heavier than No. 12 alloy, as shown in the last column of Table I.

The density of a metal is subject to variation from changes in both composition and structure. For this reason the values which are given in various books are frequently conflicting because the exact composition and structure are not stated. In general an attempt has been made in Table I to select values which are representative for the metals listed. In the case of aluminum and No. 12 alloy the values hold for dense castings. If the castings are somewhat porous they will have correspondingly lower densities, while if the impurities present are greater, the density may be increased somewhat.

WEIGHT AND TENSILE strength of aluminum alloys are less than those of other cast metals.

Their shrinkage is greater than that of iron, but less than brass or steel shrinkage.

In thermal conductivity aluminum is higher than iron.

Its coefficient of expansion is twice that of iron and steel.

Melting range of its alloys provides for adjustment in mold while hardening.

Materials for motor car construction must possess the property of rigidity as well as that of high tensile strength. The rigidity of a metal depends upon its modulus of elasticity. The modulus of elasticity for No. 12 alloy, as shown by Table II, is 10,000,000 lb. per square inch as compared with 12,000,000 to 14,000,000 lb. per square inch for gray cast iron. If, therefore, beams be made of gray cast iron and No. 12 alloy of equal weight with the weight so distributed that the depth of the No. 12 alloy beam is 2½ times as great as that of the iron beam, the deflection of the cast-iron beam will be about seven times that of the aluminum beam under equal loads. The tensile strength of pure aluminum is low but increases when it is alloyed with copper, as shown in Table III. No. 31 alloy has a tensile strength equal to that of cast iron.

The thermal conductivity of aluminum is relatively high and is about 55 per cent of that of copper at 100 deg. C. The thermal conductivity of alumium increases with rise of temperature. This increase is about 10 per cent at 200 deg. C. and 15 per cent at 300 deg. C., while at 600 deg. C. the thermal conductivity is approximately twice as great as at 100 deg. C. According to these data, taken from the Smithsonian Physical Tables, the thermal conductivity of copper decreases with rise of temperature so that at relatively high temperatures aluminum actually has a higher thermal conductivity. Aluminum has a very much higher thermal conductivity than iron and this property makes the use of aluminum advantageous in the construction of motor parts which it is desirable to keep cool. Table IV lists some of the metals in order of their relative thermal conductivity.

TABLE I. DENSITIES OF METALS

(Data for aluminum from Research Bureau, A. C. O. A. Remainder of table compiled from Smithsonian physical tables and other sources. Values for 20 deg. C., 68 deg. F.)

	Grams Per Cubic Centimeter	Pounds Per Cubic Foot	Weights of equal Volumes With No. 12 Alloy = 1
Magnesium	1.75	109	0.612
Aluminum (Al, 99.7)	2.70	169	0.944
Aluminum (Al, 99.0)	2.71	169	.....
Aluminum (Al, 98.0)	2.73	170	.....
No. 12 Alloy (Al + Cu. 7.0 to 8.5)	2.84 to 2.87	177 to 179	1.00
No. 31 Alloy	3.0	187	1.05
Zinc	7.1	443	2.48
Iron, gray cast	7.1	443	2.48
Tin	7.3	456	2.55
Manganese	7.4	462	2.59
Soft Steel	7.8	487	2.73
Brass, cast (Cu 70; Zn 30)	8.4	524	2.94
Bronze, cast (Cu 80; Sn 20)	8.7	543	3.04
Nickel	8.8	549	3.08
Copper	8.9	556	3.11
Lead	11.3	705	3.95

TABLE II. MODULI OF ELASTICITY

Metals	Lb. Per Sq.In.
Lead	2,500,000
Aluminum	9,000,000
No. 12 Alloy	10,000,000
Cast Iron (gray)	12,000,000 to 14,000,000
Soft steel	30,000,000

TABLE III. TENSILE STRENGTHS

Metal	Tensile Strength Lb. per Sq.In.
Pure aluminum, cast	12,000 to 14,000
No. 12 Alloy	18,000
No. 31 Alloy	25,000
Cast brass (Cu 70 Zn 30)	40,000
Cast bronze (Cu 80 Sn 20)	32,000
Cast iron (gray)	25,000
Cast steel (soft)	60,000
Cast copper (electrolytic)	25,000
Cast zinc	4,000 to 12,000

It is important to know the thermal expansion of a metal when it is to be used for castings such as automobile pistons, which are subject to considerable variation in temperature. The linear thermal expansivity of aluminum is intermediate between that of zinc and brass

TABLE IV. RELATIVE THERMAL CONDUCTIVITIES AT 100 DEG. C. (212 DEG. F.)
(Compiled from Smithsonian Physical Tables)

Silver	100	Tin	14
Copper	91	Iron, wrought	14
Gold	71	Iron, cast	11
Aluminum	51	Steel, soft	11
No. 12 Alloy	40	Steel, hard	6
Magnesium	38	Lead	8
Zinc	26	Graphite	4

or copper, and about twice that of iron and steel. Table V shows the linear thermal expansivity per degree for unit of length of various metals. The volume expansion coefficient may be taken as three times the linear expansion coefficient.

The shrinkage of a metal is the linear contraction in cooling from the melting point to room temperature and determines the allowance the patternmaker must use in order to obtain a finished casting of the correct size. The shrinkage of aluminum alloys is somewhat greater than that of cast iron but less than that of steel. The decrease in shrinkage as a result of alloying pure aluminum with copper and zinc, is shown in Table VI. The high shrinkage of the pure metal is one factor which makes its use difficult except for simple castings.

The purest aluminum so far obtained melts at a temperature of 658.7 deg. C. or 1217.7 deg. F. as shown in Table VII. The commercial grades of metal melt at somewhat lower temperatures. Aluminum has the relatively high boiling point of about 1,800 deg. C. and is not appreciably volatile under ordinary conditions at temperatures below 1,000 deg. C. It is not good prac-

TABLE V. LINEAR THERMAL EXPANSIVITIES
Average Expansion Coefficient, 0 to 100 deg. C. (32 to 212 deg. F.)
(Compiled mainly from Smithsonian Physical Tables)

	Per Degree Fahrenheit	Per Degree Centigrade
Zinc	0.000017	0.000030
Lead	0.000016	0.000028
Magnesium	0.000015	0.000027
Aluminum	0.000013	0.000024
No. 12 Alloy	0.000013	0.000023
Tin	0.000013	0.000023
Cast brass (Cu 71; Zn 29)	0.000011	0.000019
Copper	0.0000095	0.000017
Nickel	0.0000078	0.000014
Cast steel	0.0000067	0.000012
Cast iron	0.0000056	0.000010
Invar steel	0.0000006	0.000001

tice, however, in making castings of aluminum to heat the metal much above its melting point or to allow it to remain molten for a great length of time.

Alloys differ from pure metals in that they do not melt at constant temperature but over a certain temperature interval. Alloys of eutectic composition are an exception to this rule and melt at constant temperature. The eutectic or lowest melting alloy of the copper-aluminum series contains 32 per cent copper and melts at 540 deg. C. (1,004 deg. F.). No. 12 alloy contains 8 per cent copper; it begins to melt at 540 deg. C. and is completely molten at 636 deg. C. (1,177 deg. F.). On cooling, the molten metal begins to solidify at 636 deg. and is completely solid at 540 deg. These facts are of great practical importance in the case of this alloy because the metal is more or less plastic over a considerable range of temperatures during the freezing process, and as a result, the metal is able to adjust its form to that of the mold without damage to the resulting casting.

The specific heat of aluminum is 0.21 at room temperature. This means that the quantity of heat that would raise the temperature of a given weight of aluminum through one degree, would raise the temperature of the same weight of water through 0.21 of one degree. The specific heat of aluminum increases with rise of temperature and is about 15 per cent greater at 500 deg. C. The mean specific heat in the temperature interval, 20 to 100 deg. C., for a number of metals, is given in Table VIII.

The electrical conductivity of pure aluminum is 61 per cent of that of copper. No. 12 alloy has an electrical conductivity only about 32 per cent of the conductivity of copper. Alloys have been developed which have con-

TABLE VI. SHRINKAGES OF METALS
(Inches per foot)

Pure aluminum	0.21	Brass	0.19
No. 12 Alloy	0.18	Gray iron	0.12
No. 31 Alloy	0.18	Steel	0.25

TABLE VII. MELTING POINTS
(These are the values accepted by the Bureau of Standards and given in their Circular No. 35. They hold for samples of the highest obtainable purity; less pure samples will in general have a lower melting point.)

Metal	Degrees Centigrade	Degrees Fahrenheit
Aluminum	658.7	1,217.7
Magnesium	651	1,204
Copper	1,083.0	1,981.4
Manganese	1,230	2,246
Nickel	1,452	2,646
Silicon	1,420	2,588
Iron	1,530	2,786
Zinc	419.4	786.9
Lead	327.4	621.3
Tin	231.9	449.4

TABLE VIII. SPECIFIC HEAT
Mean Specific Heat, 20 to 100 deg. C. (68 to 212 deg. F.)
(Compiled mainly from Smithsonian Physical Tables)

Water	1.000	Zinc	0.093
Magnesium	0.248	Copper	0.093
Aluminum	0.216	Brass	0.09
Cast iron	0.12	Tin	0.055
Manganese	0.121	Lead	0.031
Nickel	0.109		

ductivities less than 20 per cent of that of copper and which have temperature coefficients of resistivity less than half that of pure aluminum.

Knowing the Other Fellow

BY ROBERT GRIMSHAW

The careful driver who knows his horses will be able to control them under adverse circumstances better than if he does not know their temperaments and capabilities. If this is true of the relations between the driver and his horses, how much more is it true of the leader and his human team, that have more species of temperament and more kinds of education, and can express their preference "without let or hindrance?"

Some men are amenable to reason; others "are open to conviction, but would like to see the man who could convince them." Some can be influenced only by "a soft word fitly spoken"; others again call for firmness, backed with authority. Some, indeed—fortunately few—must be handled like the children of the negro washerwoman, who on being complimented on their good behavior, and asked what method she employed to raise them, replied, "Ah raise 'em wid a bar'l stave, an' Ah raise 'em frequent!"

Some horses have been rendered balky by incompetent drivers, and once they have been so ruined, they must be handled skilfully until properly broken. So it is with men; if they have been oppressed and abused, it may take a period of firmness before they can be convinced that they will be handled gently if only they will respond.

Methods of Machine Tool Design

Conclusion of Third Article—Various Types of Machine Tool Gear Drives—A Number of Rules Applicable to Machine Tool Drives

By A. L. DeLEEUW

THE arrangements in use for obtaining variable speeds by means of gear shifts count up into the hundreds, and possibly thousands. It would be impossible to give rules or instructions as to which arrangement should be used unless all conditions were known. There are probably several thousand patents in existence dealing with various gear arrangements for variable speeds or feeds. The general tendency has been to make these arrangements more and more simple to operate, and to build them into a smaller and smaller amount of space. And the means to accomplish these aims have been the alloy steels, which permitted small gears to carry heavy loads; ball bearings, which did away to a large extent with friction; lubricating devices, which again reduced the friction on the shafts and made gears run more noiselessly, thus permitting higher speeds; and the automobile gear shift.

It used to be customary to make a change of speeds by removing a pair of change gears and putting on another pair, and this system is still in use for such machinery where shifts in speed are infrequent. It is not of much importance that a couple of minutes will have to be spent on a change of speed if the new speed is going to be used for days, or possibly weeks, at a time. Where frequent shifts have to be made, change gears are no longer used to any extent. When using change gears it is important to have them all with the same bore so that they can be used interchangeably. It is further important to avoid segments or any frail or

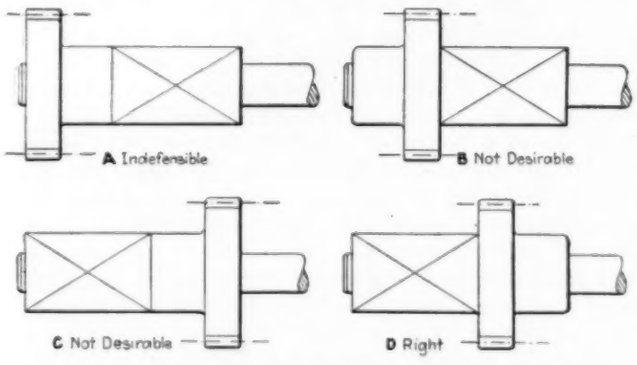


FIG. 22. METHODS OF MOUNTING HUB GEAR

loosely hitched up machine member, unless the amount of power to be transmitted is very small indeed. Where a large amount of power must be transmitted some provision should be made to support the outer end of the shaft. Where the change gears are confined in a box-like casting it should be possible to provide this casting with a lid or door containing the outward bearings for the change gear shafts.

There are two principal ways in which change gears are applied, namely, with or without the help of a movable quadrant or similar device. If they are applied without such a device, the sum of the numbers of teeth of two meshing change gears must be constant. In Fig. 23 *A* and *B* are the two change gear shafts, and *P* and *Q* are the change gears. It is possible to put a new gear on *A* with one tooth less, in which case *B* must receive a gear with one tooth more. We may continue this until we have gear *Q* on *A* and gear *P* on *B*. If the smallest gear on *B* should have *M* teeth and the

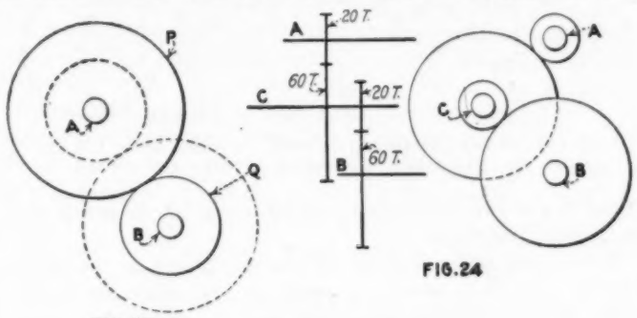


FIG. 23. CHANGE GEARS ON FIXED SHAFTS. FIG. 24. COMBINED SHIFT AND REDUCTION

largest gear on *A* should have *N*, then the sum of the number of teeth, *N* plus *M*, will be constant for any combination of gears we may put on the shaft; and the number of speeds we can obtain in this manner will be $N - M + 1$. However, if we should use all of these speeds we would sometimes slow down from *A* to *B*, and sometimes speed up; and, as particularly for heavy work, speeding up is not desirable, we will have to stop changing gears when both are of approximately even size. So, as a rule, only $\frac{N - M}{2} + 1$ change can be obtained.

Sometimes a gear *reduction* is combined with the gear *shift*. Such a device is shown in Fig. 24, where *A* and *B* are again the two shafts. A stud *C* carrying a compound gear is placed somewhere between *A* and *B*, though not necessarily in a straight line. It is not possible to say before hand how many speeds are obtainable in this manner, because there will be a time when one of the gears interferes with one of the shafts or bearings and when that time will be depends largely on the position of stud *C* in relation to shafts *A* and *B*. However, it will readily be seen that there are many more possibilities than before.

If, for instance, the pinion on shaft *A* cannot have less than 20 teeth, the gear on shaft *C* not more than 60 teeth, the pinion on stud *C* not less than 20 teeth and the gear on shaft *B* not more than 60; and if, again, we should not want to speed up—in other words, if we never wish to have a gear on shaft *A* larger than the meshing gear on stud *C*—it would be possible to have 21 speeds by merely changing these two gears. We would also get 21 speeds by changing pinion on stud *C* and gear on shaft *B*; but this does not mean that the total number of speeds obtainable will be $21 \times 21 = 441$, because if we have the combination 20-60—21-59 we will get the same speed as if we had 21-59—20-60; and furthermore, many of the speeds will be so very close together that they are of no practical value. However,

an arrangement, as the one shown here, is of great value when we want to obtain the following:

To get a variety of speeds over a wide range and so selected that we obtain as nearly as possible the proper

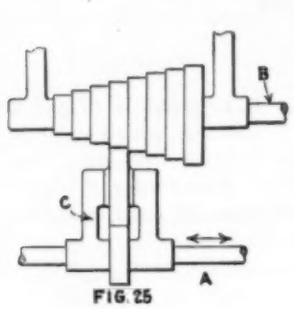


FIG. 25

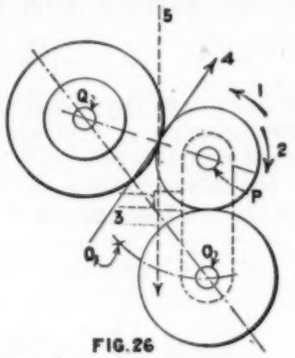


FIG. 26

FIG. 25. OLD-FASHIONED CONE, PINION AND IDLER.
FIG. 26. DIAGRAM TO SHOW ACTION OF IDLER

speed for a few operations which we wish to carry out on a given machine.

The other arrangement of change gears is the well-known system in which a segment and idler are used, such as the change gear devices on the older style lathe, on the dividing head driving attachment on milling machines, and on various other machines such as the Brown and Sharpe screw machine. As a rule, the amount of power to be transmitted by such a device is so small that it is permissible to do some speeding up. However, it should not be forgotten that this speeding up will lead to a marked irregularity in the movement of the driven shaft, something which is quite noticeable when we attempt to mill a short lead spiral.

One of the favorite devices for obtaining the number of speeds by means of gears was the cone of gears with tumbler. Originally intended for a lathe feed it was gradually applied to drives transmitting considerable power and was found to lead to serious difficulties. Fig. 25 shows a cone of gears with pinion and idler in its most primitive form. In this form the device is only adapted to light feeds. *A* is the driving and *B* the driven shaft. The driving pinion is made to slide along the shaft by means of bracket *C* which also contains the stud or shaft for the idler. A lever attached to bracket *C* and not shown in the illustration serves to move this bracket endwise and also to turn it through the necessary angle to mesh the idler with one of the gears of the cone. All the tooth pressure is against the shaft which must necessarily have considerable length between the bearings, so that all the pressure between the gears of the cone and the idler causes the shaft to bend. Many variations of this construction have been made and there are many patents in existence dealing primarily with the means for engaging the idler with the selected gear of the cone. In many of these constructions the mechanism for the handling of bracket *C* is divided in two parts—one for the axial and one for the turning motion of the bracket. With these constructions two separate movements are required on the part of the operator for engaging the gears.

In Fig. 26 is shown a couple of gears of the cone, the idler and the driving pinion in diagrammatic form. Supposing the pinion to do the driving (which is not always the case as in some arrangements the cone is the driving member) we will notice that at the moment of engagement the idler may either pull itself in or may try to push itself away, depending on the direction of rotation. In the illustration with the center of the driving shaft located at *O* and the idler running in the direction of arrow No. 1, there will be a tendency to push the idler away at the moment of engagement, which will make the manipulation difficult and, in case of the transmission of considerable power, entirely impossible. Furthermore, the idler coming into engagement in the general direction of arrow No. 1, there is no possibility of placing a stop behind the bracket unless this is done by means of a third movement on the part of the operator, after the gears are in mesh; so that in a practical arrangement of this kind there would be a constant tendency to push the gears out of mesh. Any variation in load would cause the idler to move either further out of mesh or back again to its original position.

If the idler rotates in the direction of arrow No. 2, then it will have a tendency to pull itself in, but this

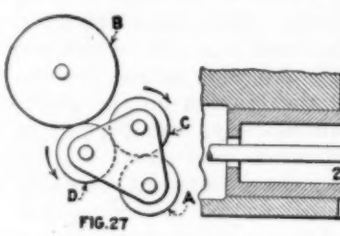


FIG.27

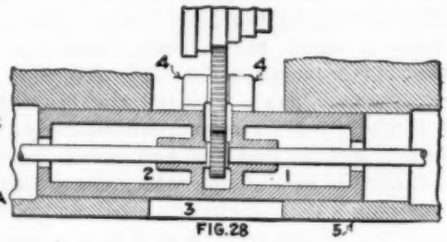


FIG.28

FIG. 27. TUMBLER GEAR WITH TWO IDLERS. FIG. 28. SUCCESSFUL ARRANGEMENT FOR LIGHTER DRIVES

tendency can be overcome by placing a stop 3, against which the bracket can bear when the gears are fully in mesh. We see, then, that it is important to select the proper direction of rotation for the driving gear.

We are absolutely sure that if the idler runs in the direction of arrow No. 1 there will be a tendency to push it out of mesh, but we are not exactly sure that it will be pulled into mesh when it runs in the direction of arrow No. 2 because this depends not only on the direction of rotation but also on the relative location of the centers *O*, *P* and *Q*, and on the angle of action of the gear teeth. The solid line 4 indicates the direction of the line of action when rotating in direction of arrow No. 1; the dotted line 5 indicates the same for the opposite direction of rotation; and as long as this line falls between the centers *O* and *Q*, there will be a tendency to pull the idler into mesh, but if the center *O* were displaced and brought into a new location O, there would still be a tendency to push the idler out of mesh, notwithstanding that it has the proper direction of rotation. A careful investigation is therefore necessary as to the relation between the centers and the line of action. Tumbler gears have been used long before the cone of gears was applied to machine tools. Tumbler gear arrangements were found in the elevating mechanism for radial drills and in the reverse mechanism for the feeds on a lathe, and considerable trouble was experienced with such arrangements because the idler was necessarily running in the wrong direction part of the time.

In Fig. 27 is shown such an arrangement. *A* is the driving gear, *B* is the driven gear, and *C* and *D* are two idlers, each of which can be brought into mesh with *B*. These two idlers run in opposite directions and only one can have the proper direction.

Coming back to Fig. 26, it would seem at a first glance that it would be always easy to give the idler the proper

direction and this would be the case if there were only one gear in the cone with which the idler must mesh. However, there are several gears in the cone, and the diameters of these gears may vary so much that in some cases the line of action falls between the centers and in another case outside of the centers. If, for instance, in Fig. 26 the center *O* were near, but still to the right of line 5, and if at the same time the gear on center *Q* were made much larger, the line of action would fall outside the line *OQ*.

A construction is shown in Fig. 28, by which the driving shaft is entirely relieved of the pressure on the gears and which, at the same time, has the advantage of making a dust-free arrangement. The driving shaft finds its bearings 1 and 2 in a sleeve or cylinder 3. Pinion and idler mesh in a gap of the sleeve, the idler being held in a bracket 4, which is bolted to the sleeve. The handle for operating the sleeve is attached on the outside and is not shown in the illustration. The sleeve can slide and rotate in the bore of the frame 5. The pressure between the gears is therefore taken up on the sleeve. This arrangement has proved to be very successful and is quite well adapted to the lighter drives and to feeds. Where heavy drives must be taken care of it is advisable to use some other arrangements on

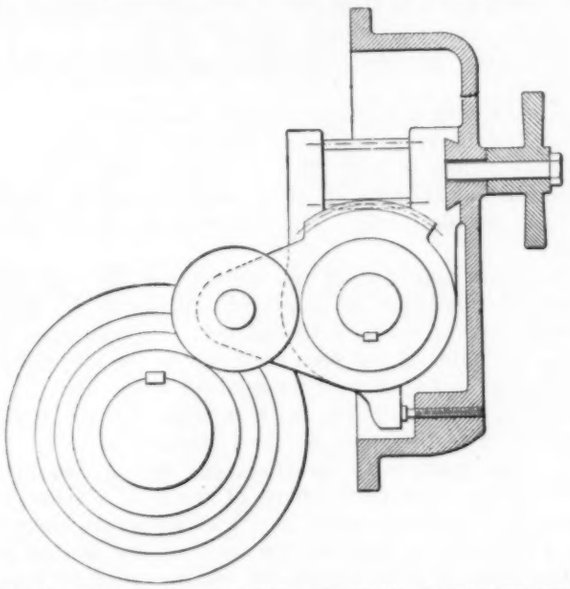


FIG. 29. HEAVY-DUTY TUMBLER GEAR ARRANGEMENT

account of the excessive size of the sleeve when the driving pinion becomes large.

In Fig. 29 is shown an arrangement used by the writer in the construction of the high-power Cincinnati milling machine, and which was called upon to transmit as much as 35 hp. In this construction a single member served to move the pinion and idler endwise as well as angularly. The endwise movement was obtained by moving a pilot wheel attached to the bracket containing pinion, idler and some other parts. When in the proper endwise position the pilot wheel was turned. This turning motion was transmitted to the bracket holding the idler by means of a worm and worm wheel, or rather a pair of spiral gears, the teeth of which had such an angle as to be self-locking. When the gears were in mesh, the turning movement of the pilot wheel was continued and this extra movement brought a hardened stop in the bracket up against a hardened pin in the frame of the machine, thus clamping the bracket in position. Here, also, the bracket supported the driving shaft instead of the driving shaft supporting the bracket, as was the case in the earlier constructions.

In order to function properly the arrangement should always run in the same direction, and this is particularly important with heavy drives. If there must be a reverse in the system, the reverse mechanism must be applied *after* the cone and tumbler and not between the first driving member and the tumbler arrangement. As there is necessarily some reduction in the tumbler arrangement the torque on the reversing mechanism will be greater after the cone of gears than before.

At one time arrangements such as shown in Fig. 30 were commonly used for changing feeds, and even in some cases for changing speeds of a machine tool. Such an arrangement is known as a pull-pin arrangement. It consists, generally speaking, of two cones of gears meshing with each other. One of the cones is keyed to its shaft, the other one runs loose on the shaft, and each one of the gears of this cone can be keyed to the shaft by means of a sliding key, operated by means of a rod going through the center of the shaft. There are many objections to this construction and it has gradually lost favor and is very seldom, if ever, used in modern construction.

In Fig. 30 *A* and *B* are the two shafts connected by the two cones of gears. Gears 1, 2 and 3 are keyed to shaft *A*, and gears 4, 5 and 6 are running loose on shaft *B*. The crosskey 7, connected to the pull-rod 8, moves in a slot of shaft *B* and can engage any one of the three gears 4, 5 or 6. In order to allow crosskey 7 to slide from one gear to the other, counterbores are provided in these gears and located so that when the crosskey is in the counterbore the gear is free to revolve. One of the counterbores is shown at 9, and the keyseated portion of the gear at 10. It is very obvious that this arrangement makes a weak construction of shaft and key and allows but little bearing of the three gears on the shaft unless the gear hubs are made excessively long, which would probably take up valuable space in the mechanism.

The question of lubrication, also, becomes a difficult one. It is not well possible to bush the gears, and it is very difficult to bring oil between the gears and shaft *B*. Undesirable as this arrangement is, it can be made worse by making *B* the driving shaft instead of the driven one. To make this clearer, we will assume certain figures for the number of teeth of the gears and speed of the driving shaft. Assuming *B* to run 300

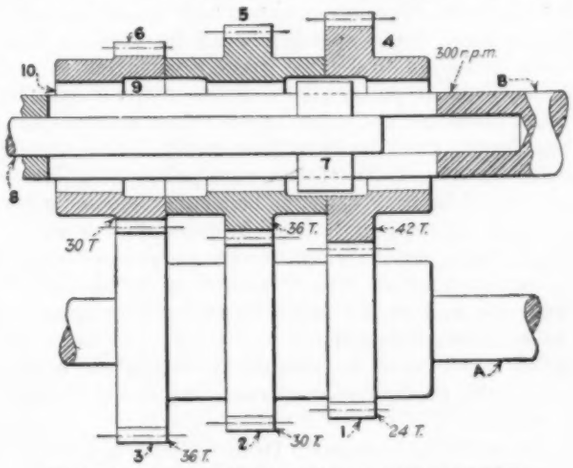


FIG. 30. PULL-IN CHANGE SPEED DEVICE

revolutions, and assuming the number of teeth to be as shown in the sketch, and further assuming that the key is engaging gear 4, shaft *A* must run 525 r.p.m.; and as gear 3 meshes with gear 6, this latter must run 630 r.p.m., which causes a relatively high speed between gear 6 and the shaft on which it runs. This condition will become still worse if there is a considerable slowing down between *B* and *A*. For this reason, if this kind of arrangement is used at all, shaft *A* should be the driving shaft.

Many variations have been made on this construction, but as none of them are desirable we will not go further into this matter.

The gear arrangement which is most commonly used at the present time and which has less objectionable features than any discussed heretofore is the so-called selective sliding gear. As an example of the application of such gearing will be given in a later chapter we will not discuss it here. We wish to point out, however, that the following rule may be put down as of quite general applicability:

For standard machinery, in which speeds or feeds must be arranged in geometrical progression, selective sliding gear arrangements are to be preferred; while for special machinery, in which certain definite speeds must be obtained, the change gear system is usually the simplest and best.

There are some other gear arrangements in existence which have their special applications and which will be taken up later on.

Try to obtain the desired amount of power by belt *speed* rather than by belt *width*. Belt speeds up to 3,500 ft. per minute are permissible in machine tools, but cannot always be obtained.

Try to obtain belt speed by a high number of revolutions of pulley rather than by a large diameter.

NOTE: The highest practical number of revolutions for a pulley depends on the nature of the lubricating system and other items. In any case, however, the shaft speed should be kept as high as conditions will permit.

Belts wider than 8 in. should never be used with cone pulleys. A 6-in. belt is difficult to shift. An 8-in. belt can still be shifted, but would not be practical if such a shift were of frequent occurrence. Belts wider than 8 in. cannot be shifted, except where some special device is used for the purpose.

The ratio between largest and smallest cone pulley steps should be kept as low as possible, so as to avoid too great a difference in the amount of power obtainable.

Where more than one countershaft speed is used the ratio between these speeds should be kept as low as possible so as not to get too great a variation in power.

As with other pulleys, cone pulley steps should be as large in diameter and of as small a face as practical.

Not less than $\frac{1}{4}$ in., and preferably $\frac{1}{2}$ in., should be allowed for the width of the cone pulley in addition to the width of belt. Where the belt runs between a larger step and a flange, $\frac{1}{4}$ in. is the minimum allowance.

Cones in the countershaft for the purpose of obtaining various countershaft speeds should be avoided as much as possible, and should never be used where speeds have to be changed frequently.

Belts which must be frequently shifted on cone pulleys should preferably not run faster than 2,000 ft. per minute.

Countershafts suspended from the ceiling on ordinary hangers should not run more than 400 r.p.m. If higher speeds are necessary the countershaft construction should be self-contained in a single casting which can be bolted to the ceiling.

Gears made by the ordinary processes, that is, without extreme care, should have speeds not exceeding 700 ft. for cast iron; 700 ft. for mild steel; 600 ft. for hardened gears; 900 ft. for bronze and steel; 2,500 ft. for rawhide, micarta or fibroid.

The gears alluded to are supposed to have been cut with a standard rotary cutter and they are supposed to run dry. Where special rotary cutters are used, or where the gears have been made by the Fellows or hobbing process, higher speeds can be used, provided that the gears are not hardened. Higher speeds can also be used when the gears run in oil or grease.

A gear which is keyed to the shaft or which runs on a shaft being bushed for that purpose, should have a sufficient number of teeth to allow for the proper thickness of metal between the root of the tooth and the top of the key or the outside diameter of the bushing. If the diameter of the shaft is considered as the pitch diameter of some imaginary gear, then the gear we design should have at least eight teeth more than this imaginary gear. Denoting the diameter of the shaft by *D*, and the pitch of the gear by *P*, we should make the gear with not less than $DP + 8$ teeth, though for light work we may occasionally use $DP + 7$.

Wherever possible, overhanging gears should be avoided.

A gear with a hub should have this hub turned away from the bearing wherever possible. A construction such as shown in Fig. 22-A is indefensible. Constructions such as shown in *B* or *C* cannot always be avoided, but are not desirable. The construction shown in *D* is proper.

Hunting cogs are of no importance for cut gears. They are, however, of some importance if the gear is hobbed with a multiple thread hob. In that case, however, the hunting cog does not refer to the two meshing gears, but to the gear in its relation to the hob. If, for instance, a gear is cut with a triple thread hob, its number of teeth should not be a multiple of three. The idea that gears with hunting cogs will gradually improve each other as to shape of tooth is a fallacy. If there is a defective tooth in one of the gears there will be a tendency to spoil all the teeth of the mating gear, rather than a tendency of the mating gear to improve the defective tooth.

Start a geared arrangement with the highest practical shaft speed in order to keep dimensions to a minimum. This is advantageous in regard to bulk and cost.

Make no unnecessary reduction, but keep shaft speeds as high as possible up to the last moment.

In making gear shift arrangements avoid as much as possible all speeding up.

Use as few groups or shifts as possible.

Make the shift by the simplest possible means, so as to avoid possible confusion on the part of the operator.

Avoid duplicating or overlapping of speeds.

NOTE: This rule should be applied with caution. There are cases, particularly in special machines, where the overlapping of speeds may be beneficial; for instance, where we have two ranges of speeds, one for roughing and one for finishing; so that a single shift will always produce the corresponding finishing and roughing speeds. In such a case it may well be that the highest roughing speed is higher than the lowest finishing speed.

And finally, the most important rule of all: None of the above rules should be applied without carefully going into the merits of the case.

Recommended Practice in Carburizing

Suggestions for the Selection of Carburizing Material—Methods of Testing It—The Best Materials for Different Kinds of Work—Design and Use of Carburizing Pots

BY S. P. ROCKWELL
Metallurgical Engineer, Whitney Mfg. Co.

IT IS to be regretted that the average purveyor of carburizing materials argues fast penetration. Furthermore, many consumers consider fast penetration as a mark of merit. Eighty to ninety per cent of the practical men who handle carburized work consider only the depth of penetration and base their judgment on this alone. They overlook what is more important—the percentage of carbon in the case and the rate at which the carbon decreases toward the core. These last conditions are excusable as few plants are equipped with means for their determination. Often the examination of a carburized product will show carbon as high as 1.60 per cent for an appreciable amount of surface depth. This will rarely interest them, but these same people would never think of using carbon steel with any such amount of carbon.

Fast penetration is, of course, a desirable feature from a cost standpoint, but it is, almost without exception, accompanied by excessive high carbon surface and its product, free cementite. In order to put the free cementite into solution, the saving made in the time of the carburizing operation is usually lost by the first or high heat of double heat-treatment.

The fact does not appear in any publication that a steel of a specific analysis has a certain rate for a certain intensity of carbon absorption. The writer, however, from many observations, believes that this condition exists. In other words, a 1020 steel will absorb an eutectic case of a certain depth in a certain length of time, and nothing will increase this time, without causing the case to become hypereutectic.

It is rather difficult to say with any degree of surety what the correct amount of surface carbon should be in a casehardened gear. For ball bearing work a eutectic case (0.86 per cent carbon) is desired. The bearing after carburizing is considered to have 1.10 per cent carbon in the outer case. The grinding, however, is calculated to remove this. Due to warpage and the resulting uneven grinding it is a question whether the results desired are always attained.

For camshaft work considerable high carbon is permissible, providing the resulting cementite is in solution and not in the free state. When properly heat-treated a mosaic surface effect is produced. Finely divided particles of extremely hard cementite are imbedded in a softer matrix of eutectic steel. This condition is excellent for retaining the film of lubrication.

The gear, in a way, is subjected to both the requirements of the bell bearing and the camshaft. The pressure per unit of contact is less than the bearing and more than the camshaft. Furthermore, the gear must resist sliding and rolling contact. It is surmised that the surface carbon should be between 1.00 and 1.10 per cent. The inspection of work to enable one to hold to these conditions is a difficult procedure, unless a standardization of the carburizing material employed is made by the user for his own particular requirements.

The question of standardization of the materials and the specifications of the same are two different things. It is probable that if more users of carburizing materials would test them out for results the makers would be forced to supply according to specifications.

One concern buying carburizing material selects at random one bag from ten, and carburizes a 1-in. bar, 6 in. long, in a 5 x 10-in. pot at 1,650 deg. F. for 24 hours and pot cools. The bar is 1020 steel and all elements are within the specification range. The bar is centered and the surface removed before the carburizing operation. After carburizing and polishing with emery to remove adhering carburizer, 0.010 in. of the surface is removed in the lathe and a carbon combustion is run on the chips. The result, together with a micro-examination of the case, decides the question of rejection or acceptance of the shipment. In the operation of such a method of standardization, conditions should permit of exact duplication. In this respect uniformity of furnaces and calibration of pyrometers are of great importance.

Summarizing a comparison between types of carburizers to compare costs, case depth, surface case, toughness and hardness we have:

		Rating
(1)	Material with the greatest zone of eutectic	25
(2)	Material showing best joining of the different carbon zones	25
(3)	Material least destroying the core strength	15
(4)	Material giving greatest hardness with freedom from soft spots on single quench	15
(5)	Material giving the greatest case depth	10
(6)	Material giving the best surface	5
(7)	Material giving the greatest economy	5
	Total	100

There are, strictly speaking, but four different types of carburizers; they are classed by their physical form as follows: (1) Powder materials, in which the generator and the energizer are in a powder form, and are thus mixed together to form a mechanical mixture. Such materials are "hydro-carbonated bone black" No. 9 "Ajax," etc.; (2) pill materials, in which the generator and the energizer are in powder form, but are held together by a binder, which in itself may be a generator or an energizer. Such a material is "carbo;" (3) pellet materials, in which the generator is a granule of solid carbonaceous material coated with an energizer by the help of a binder. Such a mateiral is "Quick Light-A;" (4) pellet and powder materials, in which the generator is a granule of solid carbonaceous materials and the energizer is in the form of a powder. A certain per cent of the powder may also be a generator. Such materials in most common use are "Bohnite," "Carbonite," "Pearlite," etc.

Three other mediums are in use for carburizing, namely, bone, leather and gas. Bone is classed as a

Paper presented before Buffalo meeting of the American Gear Manufacturers' Association.

pellet material with this exception, that the energizer is contained within the bone. Leather is classed as a powder material; its energizer is a nitrogenous compound. Gas differs from the rest in that it is the result of the carburizing property of all carburizers. Charcoal, coal and coke cannot be classed as carburizers, due to their difficulty of control. Strictly speaking, they are generators, and are sometimes used as filters.

Choosing A Carburizer

To decide on any type of carburizer, one must first know the conditions of carburizing, and the results desired.

The writer offers the following as a guide for selection:

1. For low cost, and to secure uniform case with 0.10 to 0.20 less carbon in the case than is usually secured under pot packed condition; use tumbling barrel method developed by American Gas Furnace Co. with gas or with solid carburizer. With this system heavy work will be marred, and the method is not recommended for threaded work. With solid carburizer 3 lb of material will carburize 50 lb. of work to 0.045 in. depth at 1,650 deg. F. Use any type of carburizer.
2. For fast heating use coarse mesh carburizer such as types 2 and 3. The air spaces allow room for the heat-generated gases to thermo syphon and offer unrestricted passage for heat-transference to center of pot.
3. For non-shrinkage, use fine mesh carburizers, preferably a coke type generator or a carburizer with a lot of inert filler. These latter usually contain 40 to 60 per cent of petroleum coke.
4. For low carbon case, use charcoal generator with oil hydro-carbon energizers. Such materials are "hydro-carbonated bone black," bone and charcoal.
5. For high carbon case, use chemically energized materials. Such energizers contain cyanides, barium, ammonium, salts and carbonates. Carburizers containing forms of leather are also used.
6. For deep depths, use coke and charcoal generators with oil hydro-carbon energizers combined with fine mesh and considerable inert material.
7. For very clean surface work, use charcoal and bone carburizers where the energizer is naturally contained in the bone.
8. For work which must be carburized at low heats, use raw bone or carburizers containing a large percentage of raw bone.
9. For work which must be carburized at low heats to secure mottled effects, and clean surfaces, use charcoal, charred bone, charred leather or combinations of these. Avoid chemicals.
10. For copper-plated work, use charred bone, charcoal and oil hydro-carbon energized materials, together or alone. Avoid chemicals.
11. For extreme hardness of case use nitrogen carrying compounds, which would be cyanogen energized compounds, and leather mixtures.
12. For local carburizing where compound is forced by pressure and caked about zone desired to receive an increase of carbon, use fine mesh materials combined with a semi-liquid binder, such as molasses, tar and resin.

After a decision has been made on the type of carburizer for the particular class of work it is to be used with, the user will find that he is in no way restricted as to the dealers from whom he may purchase. Nearly all the standard carburizing materials dealers make all types, but they are apt to confine their advertisements to one or two more popular types. It will further be found that each type can be purchased in different variations of mesh and grain size.

How to Buy

Buy from a responsible house.

Study what type, mesh, generator and energizer is best fitted for your work.

Consider as first cost, the cost per cubic foot rather than the cost per pound.

Test the material under conditions as nearly like regular practice as possible. This means depth, representative work shape, temperature, and pot size.

Examine the pot-cooled sample for case structure by the microscope, and by carbon combustion. The microscope will be found invaluable for this purpose. Once one becomes familiar with estimating the carbon by the microscope, the combustion method can be dispensed with except as a means of check.

Maintain your standard for future shipment of material.

If soft spots develop on the hardened work do not blame the carburizer. Soft spots are due to rust on work prior to carburizing, phosphorous banding, delayed quenching, copper or sulphate spots, slag, faulty grinding, cold-rolled or planished surfaces, scale formation, excessive oxygen in hardening fires, faulty quenching medium, too low hardening heats. These faults cannot be laid to the carburizer. The carburizer rarely makes soft spots if it contains no excessive amounts of inert filler, or burned out material such as ash dust. These conditions should be guarded against. If hardened work has soft spots, and these areas are carefully marked and the piece carefully rehardened two results can be obtained:

(1) Original soft areas become hard. In this case trouble is not due to carburizing.

(2) Original soft areas stay soft. In this case the trouble may be due to rust, copper, decarburized in hardening, or to defective carburizer.

With the aid of the microscope, polishing wheels and cloth, and dilute nitric acid, any of these conditions may be accurately discovered.

Special alloy heat-resisting pots, are by far the best investment when compared to cast iron, malleable iron and cast steel. The round pot will be found to give a greater life than the square pot, due to the equalization of expansion and contraction stresses. The cored or chimney pot is only efficient, considering its added cost, where the chimney is 5 in. in diameter or over. Too large pots should be avoided for small work. The round pot will be found most satisfactory for pinion and ring gear work. It offers the advantage of even heating, and prevents the tendency to overcrowd the furnace hearth space.

Square or rectanglar pots are best for splined shafts, but the work must be packed with due regard to the transference of heat. The size of the pot should not be greater than the work demands. This is imperative from the standpoint of handling, slowness of heating and the subsequent unevenness of carbon penetration from center of pot to outside. It is also imperative that the pot should not be greater than is required by the work on account of the slowness of cooling where work is pot cooled with the subsequent separation of the carbon zones.

The best dimensions of the pot depend largely on the furnace. Too high pots are as bad as those too large in diameter. The average furnace varies greatly in temperature from top to bottom, and this variation increases with the arch height. A well proportioned pot never exceeds in height the greatest width or the diameter. The height is best made between $\frac{5}{8}$ and $\frac{7}{8}$ of the greatest width or diameter. All pots should be cast with legs to allow circulation of heating gases. For this same reason the floor of the furnace should be scraped clean after each heat. Great care should be used in sealing of the pots. The tighter the seal the more uniform the results. No pot should be used that is cracked, as this is the cause of blistered work. The pot becomes a veritable blast furnace, containing its own fuel.

Factory Storekeeping and Material Control

The Third Article—Balance Sheets as the Material Control Center—Four Types of Sheets—When and How To Use Them

By Henry H. Farquhar

THE balance records, as has been indicated, should form the heart of the supply service of the factory, through which material control is secured. But they should do more than this. They should serve both production and accounting, if properly set up and regulated, in furnishing quick and accurate information as to the material status at any time—information of increasing value and reference as the business expands. In order that production may be adequately served, it follows that the balance sheets must be designed according to the need of that particular type of production.

Three general types of balance sheets are necessary to meet the three types of production calling for a control of replenishment under one of the plans *A*, *B*, or *C*. Each of these three general types are found in various forms, embodying different arrangements of columns designed to provide various sorts of information. No attempt will be made to present or discuss all of the possible or existing arrangements since the variety is infinite and the particular typography is a matter largely of choice and of comparatively little moment. Only the considerations necessary to the effective use of each will be taken up, illustrated by one example of each type of sheet.

Plan A. Here replenishment is governed by the amount on hand in the storeroom. This requires the simplest form of balance sheet in set-up and in operation. It needs only two main columns, one column for data relating to the material on order, providing subcolumns for the date and number of the requisition, the number of the purchase order, the amount received and the amount outstanding; and one column for the amount on hand in the storeroom, with subcolumns showing the amounts issued on what date and to what order, the total value and the value per unit. If the operation of the balance sheet presented under plan *B* is thoroughly understood, the operation of this simpler sheet illustrated by Fig. 2 will need no explanation, and no further description will therefore be given.

It must be emphasized again that such a method of regulating material has very limited applicability. It is entirely safe only when the average rate of use employed in ascertaining the minimum stock to be kept on hand is the actual rate of use throughout the year; in other words, where there is an entirely uniform rate or flow of materials. Such a balance sheet must not be expected to prove satisfactory under conditions for which it is not fitted.

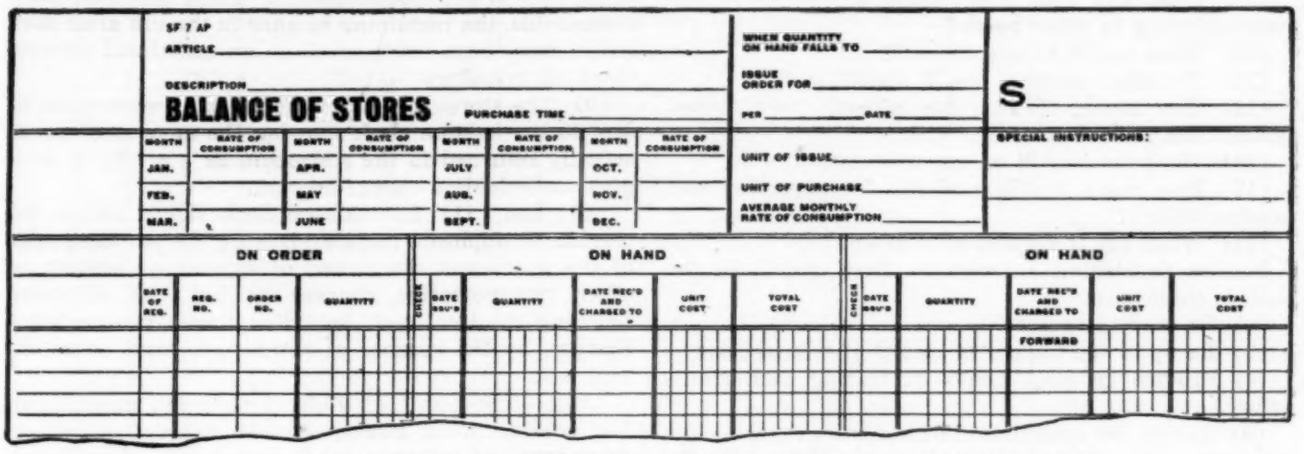


FIG. 2. PLAN *A*, BALANCE SHEET FOR REPLENISHMENT BY AMOUNT ON HAND

Plan B. The replenishment of material is regulated by the amount available. The balance sheet presented in Fig. 3 is the one needed for major materials in the over-whelming majority of manufacturing plants, since most factories have a fluctuating rate of use. This plan has been in operation in many plants for a number of years, and has proved entirely satisfactory under conditions to which it was adapted. Its use is rapidly increasing. It is unnecessary to state that the sheet is not suitable for all manufacturing plants in the particular form here presented, although it has proved of very wide applicability. Comparatively slight modifications will adapt it to almost any type of industry.

The only situation where the use of plan *B* balance sheet is unnecessary is when we have conditions described in plan *A*, and sometimes in plan *C*, conditions vary rarely encountered. This balance sheet is, moreover, suitable for use under plan *A*, since all that is necessary in such a case is to use the first two columns. It can be used under plan *C* with certain additions.

Before considering the details of this particular sheet, it is well to review its general function in material regulation. A satisfactory regulation of materials under this plan of operation presupposes the ability to answer almost immediately the questions following. Such information may and should be embodied in one central place, the balance sheet.

(1) How much has been ordered?
(2) When was it ordered?
(3) The replenishment order number?
(4) The purchase order number?

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(5) How much has been received?

(6) How much is still outstanding on the purchase order?

(7) How much does the balance sheet show is now in the bin, and how does this compare with the amount actually in the bin?

(8) What has been issued, and for what purpose was it issued?

(9) What has been returned as credit, and what order or account was credited with the amount and value of the return?

(10) The total value of material on hand, including the transportation charges where practicable?

(11) The unit value of material on hand, including the transportation charges where practicable?

(12) What has been apportioned or set aside for manufacturing or other needs?

(13) When was it so apportioned?

(14) For what purpose was it apportioned?

(15) How much, if any, has already been issued against this reservation?

(16) The balance still on apportionment?

(17) How much is still available for apportionment to other orders?

(18) When did it become so available?

Besides furnishing answers to these questions, the balance sheet must:

(a) Be easy to operate.

(b) Be up to the minute in record of transactions.

(c) Provide an easy means of tracing each transaction.

(d) Enable the compilation of statistics covering the rate of use, the time necessary to renew the supply, the cost, and other information.

(e) Provide a means for checking the clerical accuracy of the entry and balances.

What the Balance Clerk Must Do

In order that answers to these questions may be instantly available, around the balance sheet must revolve the procedure following. The topics are numbered to correspond with and answer the preceding list of questions.

(1), (2), (3) The replenishment orders must be originated by the balance clerk or must pass through his hands for entry. Besides the amount ordered, on the sheet must also be noted the date the replenishment order was issued and the replenishment order number for identification.

(4) Upon the issuance of the purchase order, a copy must be sent to the balance clerk showing the amount actually ordered. This must be checked with the amount ordered as per the replenishment order, and any necessary adjustments made. The purchase order number must also be entered for identification.

(5) Upon the receipt of a shipment, a notification of the materials received must be sent to the balance clerk. This must be identified with the purchase order, and must show the amount actually received, and if convenient, also the amount passed and the amount rejected upon inspection, although this information may be sent forward later. It is important that the notification of the materials received go forward just as promptly as possible after the shipment is in, since requests for the issuance of material not on hand lodge with the balance clerk until they may be filled.

(6) Notification of the cancellation of purchase orders or of parts of purchase orders must be sent to the balance clerk so that in conjunction with the notation of orders and of receipts a running balance of the amounts still due may be kept.

(7) Stock count is the result of an actual physical count by the storekeeper or his representative for the item, and is made entirely independent of any knowledge of the balance as shown on the balance sheet for that item. This is one of the means by which accuracy of the perpetual inventory may be maintained. Such count may be made on a few items daily so that in the course of at least four or five months the whole storeroom may be covered, and then the process is repeated.

(8) The balance clerk must record the stores and worked material issues which have been filled, showing the amount actually taken from the storeroom and issued to the shop or other departments. These may show also, if desirable, the remaining balance in the bin after such issues have been subtracted, as an additional current check on inventory.

(9) The stores and worked material credits must be sent to the balance clerk showing the amount of goods actually returned to the storeroom as a credit to some previously debited charge account.

(10) and (11) The balance clerk should secure the original or duplicate invoice, showing the purchase price of the goods and the record of express or freight, or other transportation charges against the shipment. Dividing the total cost, including these transportation charges, by the number of articles on hand, gives the unit cost.

(12), (13), and (14) Bills of material, manufacturing orders, stores issues, worked material issues, or other forms of information, showing what materials and how much will be needed in the future for manufacturing or other needs must be recorded by the balance clerk. This information is for the purpose of apportioning such demands against the material. Such information must include, for entry on the sheet, the date of these requests, and the account number or symbol to which supplies are to be charged when finally issued.

(15) From No. 8 above, after passing through the storeroom for issue, is obtained and entered what has actually been issued for this use.

(16) By subtraction is obtained the total amount outstanding on apportionment after deducting this particular issue. This total should be entered.

(17) and (18) By subtraction the amount still available is found and should be entered with the date it became available.

To make such a record intelligible:

(a) The sheet must be so arranged as to be readily understood and followed.

(b) There must be a continuous flow of such records currently through the balance sheet.

(c) Each transaction must be complete in itself and so entered, complete identification of each entry being insisted upon.

(d) The balance sheet must form a permanent record.

(e) The balances of the amount ordered, plus the amount on hand, minus the amount apportioned, must equal the amount available at any time.

In order to conform to all of these requirements, the balance sheet must have a minimum of four columns, one for entries relating to orders, the second for entries relating to amounts on hand, the third for amounts apportioned, and the fourth for amounts available. Although extremely common, the four-column balance sheet is by no means universal for this purpose,

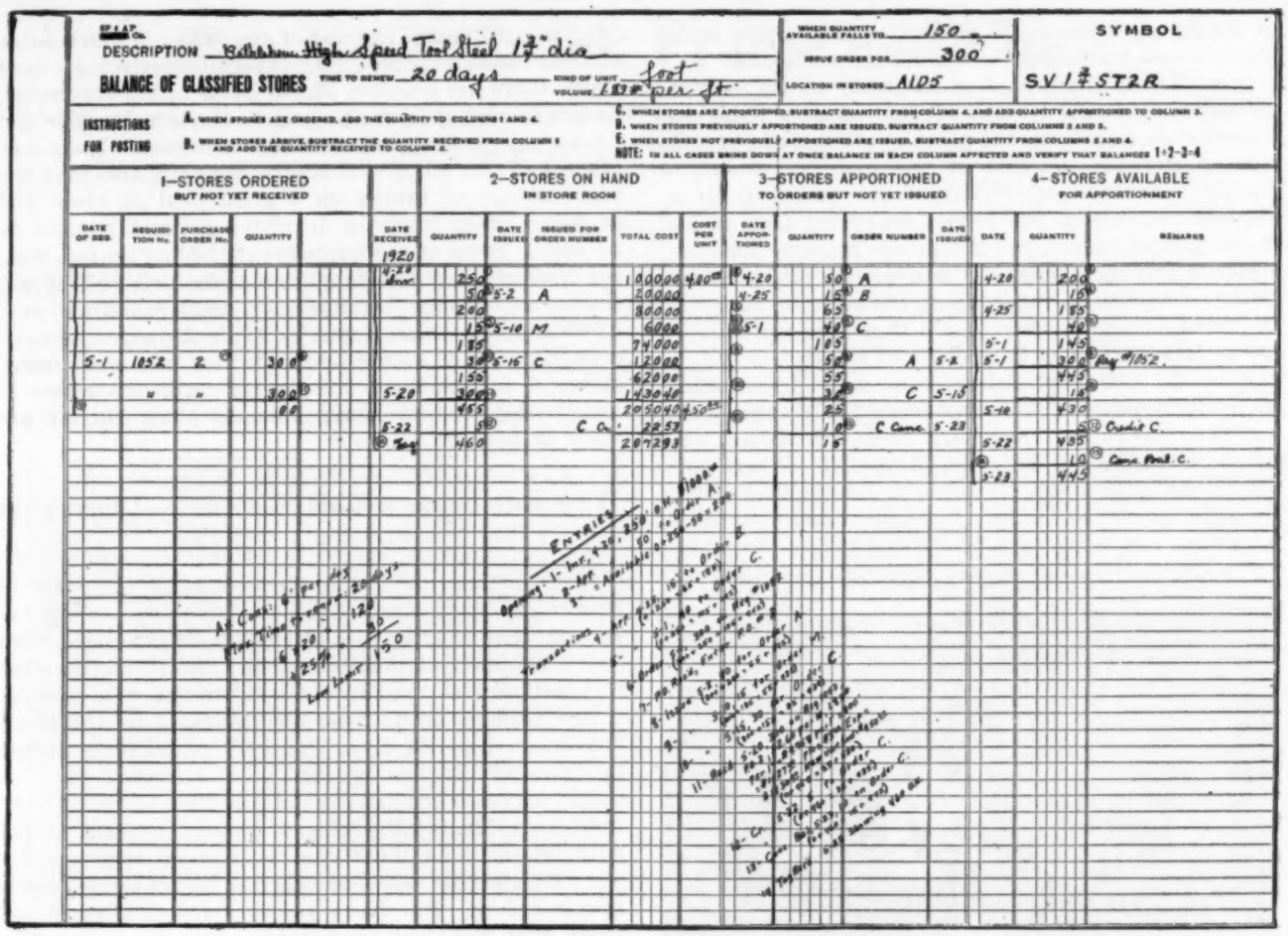

DESCRIPTION Bethlehem High Speed Tool Steel 1¾" dia
BALANCE OF CLASSIFIED STORES
TIME TO RENEW 20 days
KIND OF UNIT foot
VOLUME 18# per ft.
WHEN QUANTITY AVAILABLE FALLS TO 150
ISSUE ORDER FOR 300
LOCATION IN STORES A1D5
SYMBOL
SV 1¾ ST2R
INSTRUCTIONS FOR POSTING
A. WHEN STORES ARE ORDERED, ADD THE QUANTITY TO COLUMNS 1 AND 4.
B. WHEN STORES ARRIVE, SUBTRACT THE QUANTITY RECEIVED FROM COLUMN 1 AND ADD THE QUANTITY RECEIVED TO COLUMN 2.
C. WHEN STORES ARE APPORTIONED, SUBTRACT QUANTITY FROM COLUMN 4, AND ADD QUANTITY APPORTIONED TO COLUMN 3.
D. WHEN STORES PREVIOUSLY APPORTIONED ARE ISSUED, SUBTRACT QUANTITY FROM COLUMNS 2 AND 3.
E. WHEN STORES NOT PREVIOUSLY APPORTIONED ARE ISSUED, SUBTRACT QUANTITY FROM COLUMNS 2 AND 4.
NOTE: IN ALL CASES BRING DOWN AT ONCE BALANCE IN EACH COLUMN AFFECTED AND VERIFY THAT BALANCES 1+2-3-4
1—STORES ORDERED BUT NOT YET RECEIVED
2—STORES ON HAND IN STORE ROOM
3—STORES APPORTIONED TO ORDERS BUT NOT YET ISSUED
4—STORES AVAILABLE FOR APPORTIONMENT
DATE OF REQ.
REQUISITION No.
PURCHASE ORDER No.
QUANTITY
DATE RECEIVED
QUANTITY
DATE ISSUED
ISSUED FOR ORDER NUMBER
TOTAL COST
COST PER UNIT
DATE APPORTIONED
QUANTITY
ORDER NUMBER
DATE ISSUED
DATE
QUANTITY
REMARKS
1920
4-20 Inv.
5-1
1052
5-20
5-22
Beg.
Inv.
Credit C.
Cancel Bal. C.
ENTRIES
Opening
Transactions
Ac Cost: 6" per 145
Plus Time to renew at 20 days
Low Limit 150

FIG. 3. PLAN *B*, BALANCE SHEET FOR REPLENISHMENT BY AMOUNT AVAILABLE

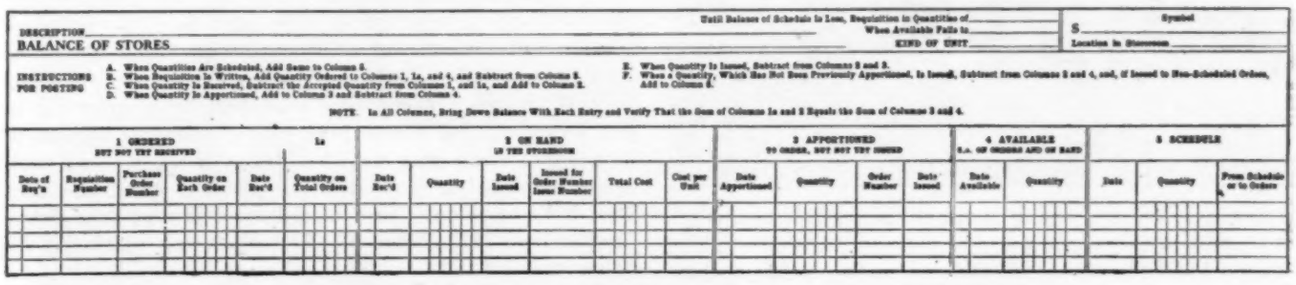

DESCRIPTION
BALANCE OF STORES
Until Balance of Schedule is Less, Requisition in Quantities of
When Available Falls to
KIND OF UNIT
Symbol
S
Location in Storeroom
INSTRUCTIONS FOR POSTING
A. When Quantities Are Scheduled, Add Same to Column 2.
B. When Requisition Is Written, Add Quantity Ordered to Columns 1, 1a, and 4, and Subtract from Column 3.
C. When Quantity Is Reserved, Subtract the Accepted Quantity from Columns 1, and 1a, and Add to Column 3.
D. When Quantity Is Apportioned, Add to Column 3 and Subtract from Column 4.
E. When Quantity Is Issued, Subtract from Columns 2 and 3.
F. When a Quantity, Which Has Not Been Previously Apportioned, Is Issued, Subtract from Columns 2 and 4, and, if Issued to Non-Scheduled Orders, Add to Column 5.
NOTE. In All Columns, Bring Down Balance With Each Entry and Verify That the Sum of Columns 1a and 3 Equals the Sum of Columns 2 and 4.
1 ORDERED BUT NOT YET RECEIVED
1a
2 ON HAND IN THE STOREROOM
3 APPORTIONED TO ORDER, BUT NOT YET ISSUED
4 AVAILABLE S.A. OF ORDERS AND ON HAND
5 SCHEDULE
Date of Req'n
Requisition Number
Purchase Order Number
Quantity on Each Order
Date Rec'd
Quantity on Total Orders
Date Rec'd
Quantity
Date Issued
Issued for Order Number Issue Number
Total Cost
Cost per Unit
Date Apportioned
Quantity
Order Number
Date Issued
Date Available
Quantity
Date
Quantity
From Schedule or to Orders

FIG. 4. PLAN *C*, BALANCE SHEET FOR REPLENISHMENT BY SCHEDULE

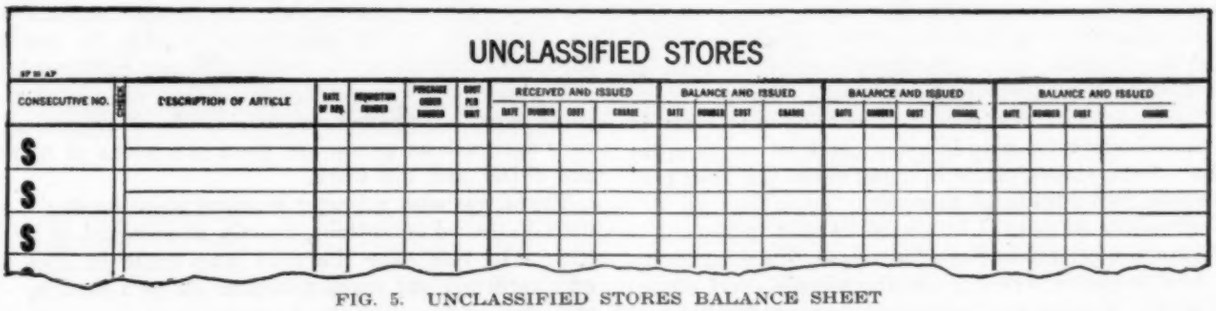


FIG. 5. UNCLASSIFIED STORES BALANCE SHEET

and various numbers of columns from four to possibly a dozen are encountered.

In the more elaborate and clumsy sheets, I have never found features embodied which could not be incorporated in the four-column sheet. For clearness, for a small amount of clerical work, and for the general ease of operation, it is usually to be preferred. The objection most generally made to it is that it does not provide separate columns for the entry of the amount received, the amount issued and the amount still on hand, for ease in tabulation. As can be seen on the sheet in Fig. 3, however, each of these entries may be readily picked out

by paying attention to the respective date entries which identify each transaction in the different columns.

A review of the preceding summary of transactions necessary to the operation of this balance sheet will immediately emphasize the point so often made that the balance clerk is the hub of the material procedure. Hardly a transaction of importance occurs from replenishment to issue which does not spring from or lead to the balance sheets, and if they are properly used they constitute an encyclopedia of information to anyone who desires to know anything about the state of materials. It should be unnecessary to add that such work should not be intrusted to an inexperienced clerk.

Plan C. The replenishment is made by schedule. Once the requirements in materials for a considerable period in the future are known, there are several ways in which the desired flow may be secured. Where plans may be followed without variation, the simplest method is to list or put on ticklers the dates when the various purchases are to be made. This method, however, provides for no follow-up in case production becomes more

FIG. 6. ARRANGEMENT FOR 5,000 BALANCE SHEETS

or less than planned. In such cases the balance sheet described for Plan *A* may be satisfactory to use where production is not too irregular. The balance sheet illustrated in Fig. 4 may be more serviceable where we can look ahead a long time but where the rate of production is not predictable. This sheet is similar to that of Plan *B*, with the addition of a schedule column.

A balance sheet for classified worked materials in design and operation may in some cases be very similar to that of the stores, while in other cases the need may be felt for two additional columns.

Unclassified Stores.—Little need be said in regard to the balance sheet for unclassified stores, since its operation will be entirely clear from the sample sheet shown in Fig. 5. This is used only for items which are not regularly stocked, but which are ordered for special purposes and ordinarily issued for those purposes just as soon as received. This sheet should be inspected from time to time to catch recurring items which may be transferred to the classified list and kept in stock.

Although loose cards of various sizes instead of sheets are frequently found in use in balance record files, it is felt that in general the use of the latter is much safer and more satisfactory. The danger of misplacing a card where there are possibly 30,000 items in the storeroom, each requiring at least one card, is very considerable and causes extreme annoyance when it occurs. Loose-leaf binders of this number of sheets, however, also have the disadvantage of taking up a great deal of room and of being either heavy or involving a great number of volumes. Some of the improved card-filing devices remedy both of these defects quite satisfactorily. Figure 6 shows a compact arrangement accommodating over 5,000 separate balance sheets. This file gives a maximum number of sheets or cards in a minimum space, makes it impossible to misplace a card, and makes it unnecessary to lift heavy volumes since entries are made in position.

Who Remembers This Bicycle?—Discussion

By Albert A. Bailley

In an article under the above title on page 381 of American Machinist, I. B. Rich is quite correct in stating that shafts with multiple splines were used before the days of the automobile; also in stating that this method was used in the construction of a bicycle.

The 1896 model Tribune bicycle, made by the Black Manufacturing Co., Erie, Pa., had its cranks attached to the shaft in this manner. I distinctly remember this, because I ground the cutters used in milling the broaches. Mr. Rich's friends evidently belong to the younger set, who think that everything they see for the first time is new and original because they never saw it before. But there are very few devices in use today that have not appeared in some form or other many years ago.

I was at one time employed by an old-time concern that started in business in the early part of the nineteenth century. About 1904 this firm happened to be hard pressed for cash, and as a last resort decided to cash in on a scrap pile that had been growing in the basement for about fifty years. At the bottom of this scrap heap was found a large black walnut tool-chest. On being opened this chest disclosed the fact that it had belonged to a man named Mudge who flourished about 1841, some of the tools being marked with the name and date.

This man Mudge was evidently a genius and an excellent mechanic, as the chest contained many clever specimens of his handiwork. Among the contents were an adjustable spirit level, very similar to the best adjustable levels on the market today, a clamp lathe-dog which to my knowledge has been re-invented many times since, a number of hand-made skew gears, not very accurate as gears, but good specimens of hammer and chisel and file work.

There was also a partly finished piece having a stud with V-shaped serrations, exactly as referred to by Mr. Rich. In this case the stud was made of tool steel and hardened and made to act as its own broach. The end was made slightly tapering and the serrations were pressed instead of being cut in the hole, though the hole appeared as if broached.

A method resembling this has been used for a good many years, in holding the crossbars in chuck wrenches and T-tap wrenches, excepting that the serrations were produced with a knurling tool, and the parts are not hardened.

The Mack Truck Frame and Chassis

Drilling and Riveting the Frame—Rivets Heated by Electricity—Motor Storage Racks—Final Assembly of Complete Truck Chassis

By FRED H. COLVIN
Editor, *American Machinist*

THE channels which comprise the side frames are drilled with reversible drilling fixtures as shown in Figs. 1 and 2. These fixtures are located from the ends of the channels and are held against side movement by setscrews when necessary. Both Figs. 1 and 2 show different applications of motor drives to heater and they are automatically, quickly, and uniformly heated. The pedal opens the contact for placing and removing the rivets.

Occasionally additional drilling needs to be done, as shown in Fig. 4. An air drill is used for this purpose and the "old man" or support shown has proved to be

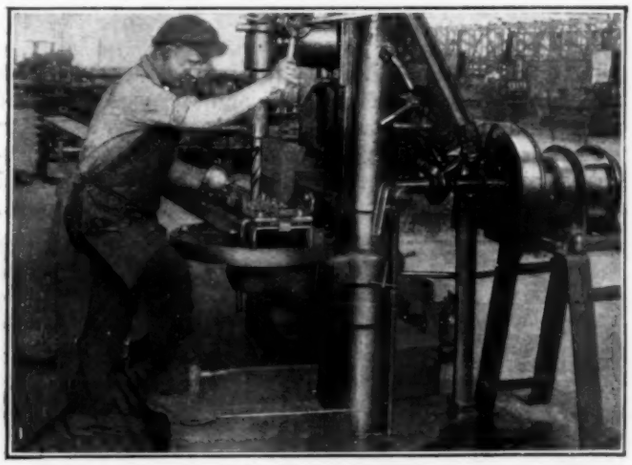


FIG. 1. DRILLING THE FRAME.

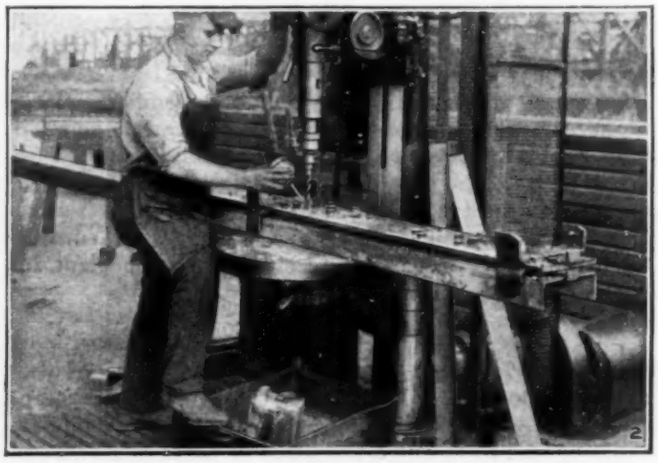


FIG. 2. THE DRILLING FIXTURE

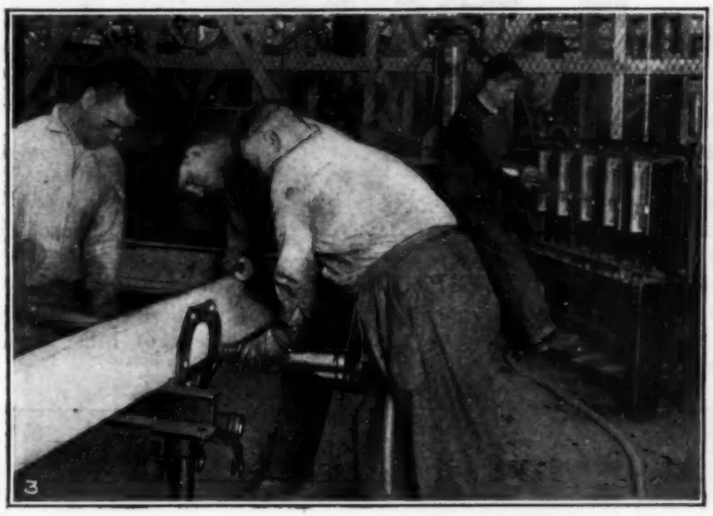


FIG. 3. RIVETING THE FRAME.

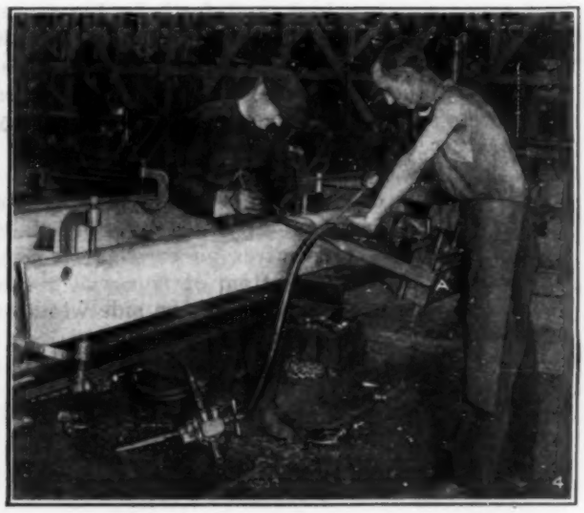


FIG. 4. DRILLING ADDITIONAL HOLES

two drilling machines. In the case of Fig. 1 the motor is mounted on a neat stand. The reducing gears are enclosed in both cases.

The riveting of the frame shows in Fig. 3, how the four men work together in handling this work quickly. The man in the center puts in and removes the temporary bolts for holding the frame in position while the first few rivets are being driven. Two others handle the riveting hammer and "holder on" while the fourth man keeps them supplied with hot rivets heated in the electric furnace shown. It is only necessary to place the rivets between the contact points of the

very convenient. It consists of a U-shaped piece of bar iron with hooks on the end and the legs given a quarter turn as shown. This device is very convenient and saves considerable work on the part of the operator, as the side bars take the turning reaction from the drill cut. At the outer end is a substantial wooden block *A*, which carries the drills needed in suitable holes.

In Fig. 5 is shown the type of stands used in assembling the frame, and also a frame partially completed, including the heavy end cross-members which carry the side hooks for towing or being towed.

In the background is seen part of the motor storage,

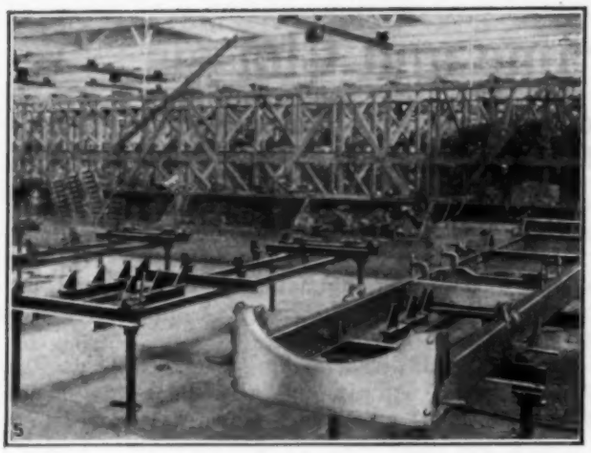


FIG. 5. THE ASSEMBLY STAND.

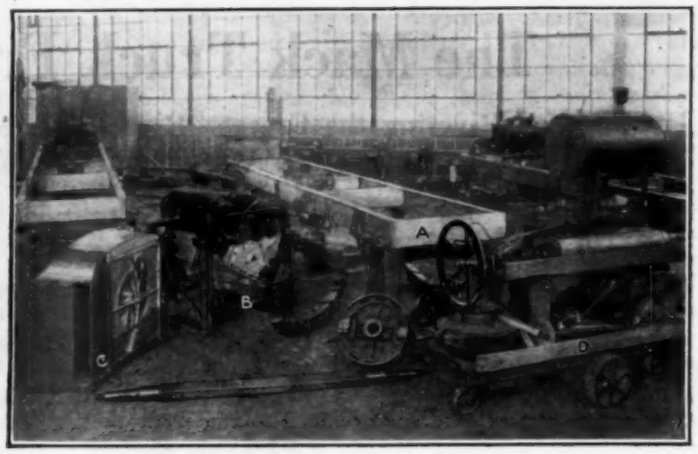


FIG. 7. PARTS READY FOR ASSEMBLY

a closer view of which is shown in Fig. 6. This view gives some idea of the capacity of the assembling plant at the Allentown shop and shows the systematic manner in which the parts are stored. Suitable provision is made for handling the motors to and from the racks, and one of the trucks used is shown in the next cross aisle. This rack has a storage capacity for several hundred motors which are received from the plant in Plainfield, N. J.

The Assembly Floor

In Figs. 7, 8 and 9 are shown three views of the assembly floor. In Fig. 7 the frame has just been placed at *A*, the motor in its stand at *B*, a complete radiator unit at *C*, and a truckload of parts at *D*. These trucks are filled in the stock department with just the right number of parts to complete a truck assembly. This saves running back and forth to the storeroom and also the loss due to parts becoming mislaid, or tucked away under benches, as was too often the case under old methods in many shops. Springs, axles and other parts are shown convenient for the assembly and the work proceeds very rapidly when an assembly gang moves to a new frame.

Another view of the assembly line, showing the motors, trucks and various parts in different stages, is seen in Fig. 8. It also gives an excellent idea of the layout of the shop, the system of monorail hoists and the splendid lighting, both from the side windows and the construction of the roof.

In Fig. 9 is shown a truck chassis of the chain drive type nearly assembled. Careful provisions are made both for the safety of the men and the expediting of the work and when a truck frame reaches the assembly floor it is a comparatively short time before it is completely assembled and ready to drive out for its road test and to receive the body which is to be supplied.

FIG. 6. MOTOR STORAGE RACK

Allentown, incidentally, affords an excellent opportunity for testing trucks as it has a variety of hills in all directions.

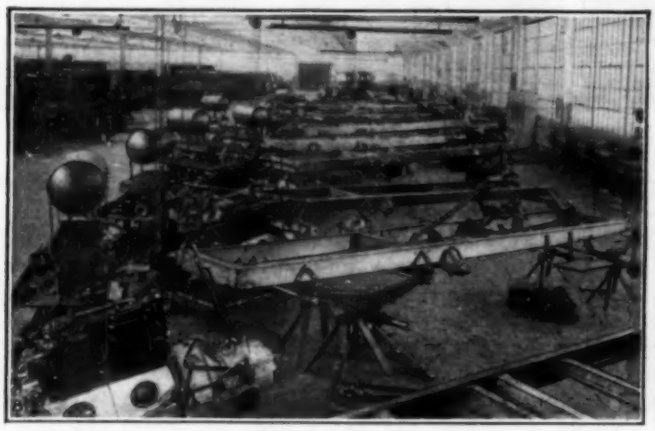


FIG. 8. THE ASSEMBLY LINE.

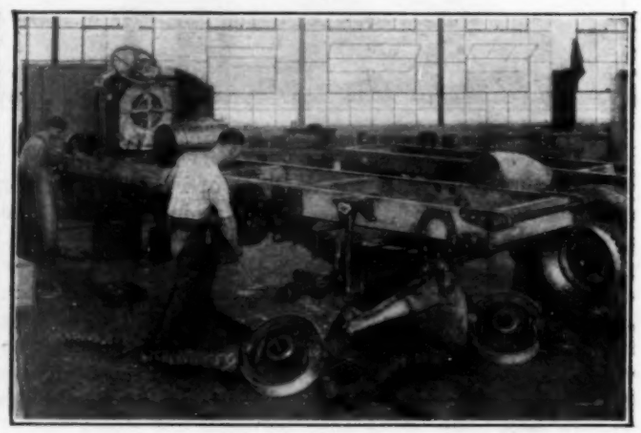


FIG. 9. PUTTING THE TRUCK TOGETHER

The Maintenance of Textile Machinery

Purpose of Ball Bearings and Importance of Proper Lubrication—Common Abuses and Suggested Corrections

By EDWIN H. MARBLE
President, Curtis & Marble Machine Co., Worcester, Mass.

A MEMBER of a well-known firm of appraisal engineers recently stated that it was not practical to adjust values of textile machinery by any known annual depreciation percentages. Two machines placed in operation in different mills, receiving attention or lack of attention, will be represented on the valuation sheet by quite varying figures. It is the hope of the writer of this paper that some suggestion may be made that will bring the two valuations nearer together and assist in a better maintenance of the textile machinery that has been installed in so many of the mills.

We will take for specific illustrations that class of machines with which the writer is most familiar, namely, cloth-room machinery. The suggestions, however, will apply equally well to most of the machinery found in our textile mills. When machinery is being constructed by the builder, the frame is carefully leveled and the various bearings are adjusted and the machine, when placed in its proper position on the mill floor, should be carefully leveled and then securely fastened in its position. Several times we have had called to our attention a very careless carrying out of this suggestion. "The legs seem to be firm on the floor and the machine must be all right," was the report. This leveling is particularly important with machinery that has considerable length along the line of the main driving shaft, such as spinning frames, or with machines that have fine adjustments, such as shearing machines. Having attended to this particular feature at the installation of the machines it is well to repeatedly test out the stability of the leveling.

With the machine in position and various attachments and revolving parts in place, see that the bearings are not too snug and that each roll or shaft turns freely. We all expect a certain degree of stiffness in new machines and no matter how finely the builder may have made his fits, the transferring of the machine from one floor to another will have varied the adjustment to some extent.

The Importance of Lubrication

With the machine starting off smoothly, what suggestions can we make to assist in maintaining its operating condition? Lubrication is possibly one of the prime considerations. Often it is no oil, an unstable oil, or a surplus of oil. The same oil cannot well be used on the high-speed spindle and the slow-revolving main shaft. The type of bearing may not be suitable for some of the heavy non-fluid oils. A regular system of oiling up should be practiced. Every morning the operator should see that any exposed oil holes are carefully cleared out and enough suitable oil applied to lubricate each bearing.

On many textile machines you will find ball bearings of various makes and they require considerable attention. First, we would ask why these particular devices were installed. Reducing all the answers to their lowest terms we find three reasons; they reduce bearing friction and save horsepower; they render good service by the saving of oiling troubles; or they were installed because some salesman convinced some one that he had a panacea for most of the ills mechanical devices are troubled with. The first answer is a rather limited one, for while the actual saving of horsepower is in many cases quite an item, the application of ball bearings to a particular revolving body should be considered carefully and the condition of working load examined and charted before any new installations are made.

In almost all cases the machine builder has looked the designing of his machine over pretty carefully before he has sent it out and is a fairly good judge of when and what kind of a friction-reducing bearing can be used to advantage.

Lubrication of Ball Bearings

Now regarding the second reason, which concerns the lubrication side of the ball-bearing question, any ordinary bearing must be oiled frequently. The installation of a proper ball bearing will in many cases reduce to a considerable extent both the time required to oil and the amount of oil used. The frequent oiling of ordinary bearings oftentimes breeds carelessness, and the surplus oil, conveyed to stock or fabric, produces damaged goods. This can be prevented in a great measure by a careful consideration of the application of a suitable friction or lubricant-retaining bearing.

Do not for one moment think your troubles are ended when your ball bearing is installed. A ball bearing allowed to run dry can do as much damage as can any other type of dry-running bearing, and perhaps from a financial point of view much more damage. We can not attempt to tell how often a ball bearing should be repacked with suitable heavy oil or grease. The load under which it runs, the speed of the shaft and type of lubricant-retaining washers or felt that is used, all have an influence on this. Three or four times a year may be necessary for one bearing, while another bearing can be allowed to run for six months without injury. But plainly speaking, every bearing must receive attention or your maintenance costs mount upward rapidly.

In the textile industry more than in any other, the ball-bearing salesman seems to have found a large number of gullible customers. Draft rolls on a cotton-brushing machine, approximately 1½ in. in diameter, revolving 60 to 100 turns per minute, have been equipped with expensive self-alignment, self-adjusting, felt-washered, oil-retaining bearings, guaranteed to reduce the horsepower required to run the machine from 30 to 50 per cent. The large percentage of the horsepower required is consumed in drawing the cloth through the machine. The friction load on the bearing is very small and rarely have we seen any noticeable saving in power by such an application. On the other hand we have noticed on some machines ball bearings subjected to a heavy working load that have failed to stand

Paper presented at the spring meeting, Atlanta, Ga., May 8 to 11, 1922, of the American Society of Mechanical Engineers.

up. This was due to misunderstanding the conditions or being afraid to ask a high price for the installation, so the salesman had equipped the machines with bearings much too light for the duty required. Hence when in doubt about ball-bearing equipment on an old type of textile machine, ask the maker.

Many machines receive power in some of their parts through friction clutches, and few mechanical movements have been subjected to so much abuse as have these devices. From a standing position you throw into action from ½ to 10 hp. and expect an immediate response at approximately full speed. Promptness of action is demanded, yet little attention is given to the mechanism that must respond to the demand. The cone, or actuating part, is probably scored by the lever being too tightly pressed against it; as the clutch is handled the starting load is in excess of the best efforts of the friction band. Most clutches are designed to produce a pressure rapidly increasing toward the end of movement, yet the movement is often so rapid that the start is not made until the extreme throw is completed. Through severe use the friction-creating surfaces are roughened so that instead of a gradually increasing friction application, the action is a grip or bite, demanding an immediate response on the part of the standing portion. Every application of the lever increases the roughness and necessitates more serious consideration of the remedy which eventually must be applied.

Give a little attention to the friction creating surfaces, cleaning them of gum or grease, smoothing any irregularities that may have been formed and particularly adjusting the toggle or connecting unit between the cone or actuating part. In fact, see that the clutch, as a whole, is in condition to respond to the call for its services. You are not dealing with a yielding movement like a leather belt, but rather a somewhat rigid device that depends on the frictional contact between two metallic surfaces for the transmission of energy—a splendid device when properly cared for, but usually one of the most abused attachments on any textile machine.

Belting in a Textile Plant

The moment any one says, "use belting in a textile plant," some one else has his dissenting viewpoint. Every belt has to adjust itself in passing over a pulley, according to its thickness and flexibility. A stiff, thick belt on a small pulley is giving the operator about 60 per cent of the value of the proper belt. An overcrowned pulley of small diameter is another loss of power. That any piece of leather or perhaps canvas is good enough to transmit power, seems to be the idea of some of those in charge of textile plants, and one will find stiff and non-flexible belting being used to transmit power to a series of rollers at high speed and equipped with comparatively small pulleys. The result is that the belt will not conform to the arc of the pulley and hardly has time to straighten itself after leaving one curved surface before it must reverse its curvature in going around a second pulley. A pliable single belt of good quality will transmit more power and maintain more uniform speed. Then belts are often put on with little attention to conditions. The leather is stiff, dry and without flexibility and the belts are united by heavy hooks or plates, driven into the leather, with the ends probably not cut off square, so that the joint is irregular.

Perhaps a final word will suffice about belt hooks, lacing, plates or other means of connecting the ends of belts. The nearer the joint is to the thickness of the belt and the more flexible its character the better. How many machines are deprived of much of their usefulness by a disregard of the small things which enter into their construction. A thumbscrew may hold some attachment in position; it is lost and a piece of string or frequently a strip of cloth is used in its place. This makeshift is so inadequate that more or less loose motion continually takes place, and due to the resulting constant wear the attachment is soon either discarded or becomes inoperative. A cover is flopping about because some one broke the hinge or tore it from the wood or ironwork. Even a belt shipper is rendered unsafe by the wearing of the retaining section. We find shipper levers retained in place by a stick or block or wood and the discovery of this condition by a safety inspector prevented serious accidents in two cases known to the writer. "A stitch in time save nine" can be applied to mechanical devices as well as to a pair of trousers.

The Treatment of Bearings

Have you ever noticed the treatment which bearings receive in different textile plants? A driving shaft of suitable size has been installed on a machine by the maker. It is subjected to some hard usage, runs at a somewhat high speed and is carried in well fitted bearings lined with some anti-friction or babbitt metal. It may have been 1⅛ in. in diameter originally, but neglected by the oiler both the shaft and babbitt eventually wear down and you have perhaps a 1⅛-in. shaft running in an oblong hole 2 x 2¼ in. The result is a worn shaft wobbling around in a somewhat restricted space. At last the operator or foreman succeeds in calling a mechanic's attention to the condition and when the latter has time he takes out the shaft, removes it to the machine shop, finds it is out of round, turns it over to any odd size, takes off the bearings, knocks out the old babbitt and proceeds to rig up some blocking to rebabbitt. Without taking pains to center the shaft or to line up the bearings, he pours in his metal, chips off the surplus and repeats the operation on the cap to the bearing. He then endeavors to replace the bearing in its old position, but as it is not true in alignment, he either packs up his bearing or the cap with cardboard or paper and finding he can turn the shaft in its revamped housing, goes off contented. Now this is not a notion or fiction, but has been found by the writer in more than one case.

Let us suggest a plan of procedure. Turn your shaft to some special size, and carefully center the shaft in the bearings while they are in position. Then pack up under the shaft so as not to occupy quite one-half of the bearing, pour your bearing, and repeat the operation with the cap, packing up the ears to the cap so as not to have a full half of the shaft in the cap. But remember one thing, the shaft that you use to babbitt the boxes in has been subjected to considerable heat. Take it back to the machine shop, true it up and then scrape your babbitted bearings to this straightened shaft until you have a good running fit. See that you have cut new oil grooves in both box and cap and on leaving your completed job, quietly suggest to the operator that a little more attention to lubrication would assist you indirectly.

Ideas from Practical Men

Devoted to the exchange of information on useful methods. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. The articles are made up from letters submitted from all over the world. Descriptions of methods or devices that have proved their value are carefully considered and those published are paid for.

Machining a 30-inch Pipe

BY WILLIAM G. HAMMERSTROM
Chief Engineer, Lynchburg Foundry Co.

In the first operation for machining the bell and spigot ends of a 30-in. flexible pipe, the outside of the bell is turned to exactly 44½ in. in diameter and 4 in. in width. An allowance is made on the inside diameter of the steel band to make a tight grip over the bell in shrinkage. In this machining, the straight spigot end is placed against the faceplate of the lathe and is secured by means of four chuck jaws. A specially designed cast-iron spider is placed on the inside of the bell supported against the lead ring, and is held against the inside wall by means of screws. The spindle of the tailstock is placed in the center of the spider and the outside of the bell is turned in the usual manner of turning in an engine lathe.

The machining of the inside lead ring is the second operation. To accomplish this, special tools and rigging are necessary. The carriage is first run up on the ways of the lathe and out of the way, since it is not used in this operation. The pipe is held in the chuck of the faceplate, as in the first operation, and a large, heavy steadyrest made in two halves is placed over the runways of the lathe, as shown in Fig. 1. The supporting arms of the steadyrest are brought up against the finished outside diameter of the pipe and adjusted until the pipe runs absolutely true. The arms are fitted with removable brass shoes.

A specially designed cast-iron stand is placed over the ways of the lathe in front of the bell. On the top of the stand is a large, integrally-cast hub bored out to take the spindle of the tailstock. In this way, the tool is rigidly held. A centrally pivoted arm moving radially on the top of the stand carries a small tool and is fed by means of a screw secured to the handwheel.

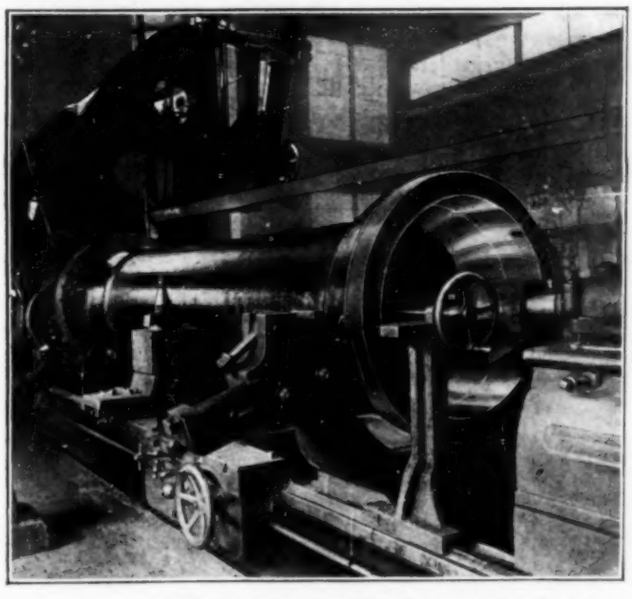


FIG. 1. MACHINING THE INSIDE LEAD RING OF THE BELL END OF A 30-INCH PIPE

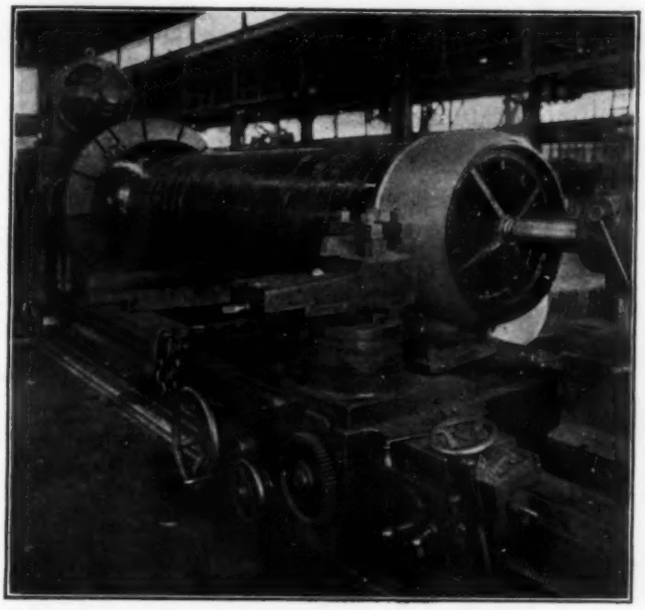


FIG. 2. MACHINING THE SPIGOT END OF A 30-INCH PIPE

The turning of the handwheel advances the arm and permits the tool to cut. The center of the arm is located accurately in relation to the face of the bell and is the same as the center of the ball of the spigot. The radius from the center of the arm to the point of the tool is also the same as the radius of the spigot.

These operations finish the machining of the bell end, after which the pipe is transferred to a 60-in., heavy, motor-driven, engine lathe for the machining of the spigot, as illustrated in Fig. 2. The spigot end is made straight to facilitate foundry practice and so it becomes necessary to remove no less than 400 lb. of surplus material in the form of heavy chips before the final finishing cuts are made. The pipe is placed in the lathe in the usual manner with the chucks on the faceplate gripping the inside of the bell while the spigot end is held by means of an inside spider.

To obtain an accurate spherical curvature of the spigot a cast-iron bridge is bolted to the outside way of the lathe, which clears the carriage and is long enough to permit the necessary horizontal travel of the carriage. A heavy forged steel link connects the bridge with the toolpost which is free to travel in a straight line towards the pipe. This link is fitted carefully to ground tapered screwed pins and is held by heavy nuts. The distance between the centers of the pins is equal to the radius of the ball on the spigot.

Placing the toolpost and tool carriage at the end of

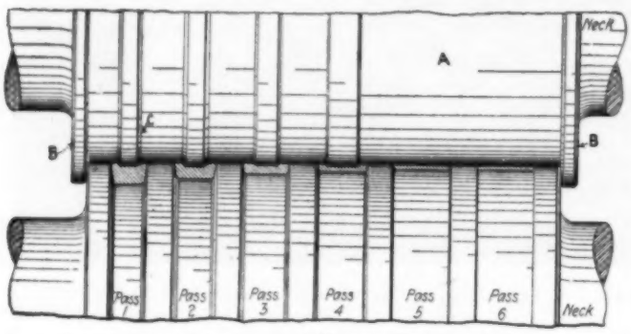
the spigot with the feed engaged, advances the carriage on the ways towards the headstock. Since the toolpost is free to move, the tool is held out by the link, making the outer radius until at the center the motion of the toolpost changes its direction and the tool is brought towards the pipe, thus forming the inner radius. The continuous motions make a perfect spherical surface. A light and final finishing cut is taken to make a smooth and even surface.

Rolls for Spreading Billets

BY C. F. GEORGE

The rolls illustrated were designed especially for the spreading of square steel billets, an operation which is considered an impossibility by many steel manufacturers, it being a well-known fact that metal when rolled will elongate rather than spread.

With a set of these rolls it is possible for sheet manufacturers to buy square billets that were intended to make shells, heat them and roll them into flat plates for making sheet billets. With a proper arrangement of the mill these billets could be heated, rolled into plates, sheared and put through the sheet rolls all at one heating. The writer designed the rolls illustrated, had them made and was able to roll plates 6 in. wide by ½ in. thick in six passes from billets 3½ in. square.



ROLLS FOR SPREADING BILLETS

The top roll *A* has two end guides *B* and grooves or serations were cut across the projections *C* to provide the means of carrying the steel through the rolls. The square billet was heated and successively put through the passes, being turned over between each pass. The idea of this was so that the finished strip would have no raw edges, which would otherwise be the case, as the turning over process while rolling, kneads the raw edges into the bulk of the metal.

Making a Connecting-Rod Bearing

BY GUY COCKLIN

It may be of interest to know how I take care of orphan cars when they lose a bearing. I first get a couple of pieces of 2 x 4-in. hard wood, free from cracks or checks, or any pieces of wood that are suitable. I face one side of each so that they lie flat together as in Fig. 1. Next I chuck them in the lathe and bore a hole, slightly smaller than the crankpin; about 0.010 in. small will be found to be about right as the babbitt will pile up in the mold.

Then I take a sharp boring tool and bore out the form of the bearing in the wood (Fig. 2) to about 0.030 in. over the size of the connecting rod it is to fit. I take a piece of sheet iron of about No. 20 gage and make a trough and clamp it in the tool post so as to run the babbitt into the hole of the mold held in the

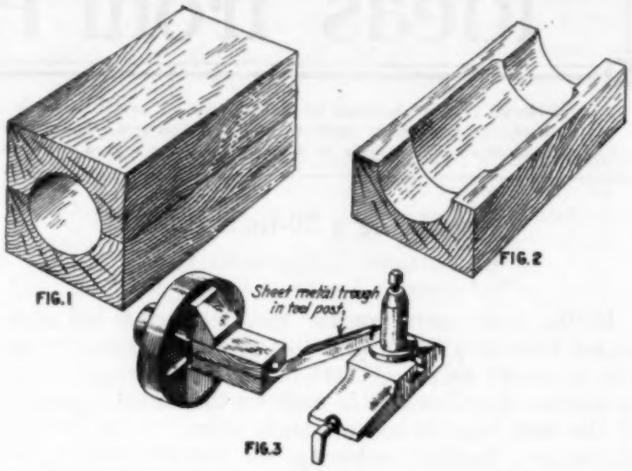


FIG. 1—THE BLOCKS BORED OUT. FIG. 2—THE RECESS FOR THE BEARING. FIG. 3—READY TO POUR THE BABBITT

chuck (Fig. 3) while the lathe is running about 1,000 r.p.m. When the hot babbitt is poured in, the centrifugal force throws the metal out into the form, leaving a hole slightly smaller than hole first bored in the block. When it hardens I bore inside of the bearing without removing the block from the chuck, then remove the blocks and take the bearing from the mold and place it on a mandrel. Finally I machine it to fit, cut the oil groove and saw in half.

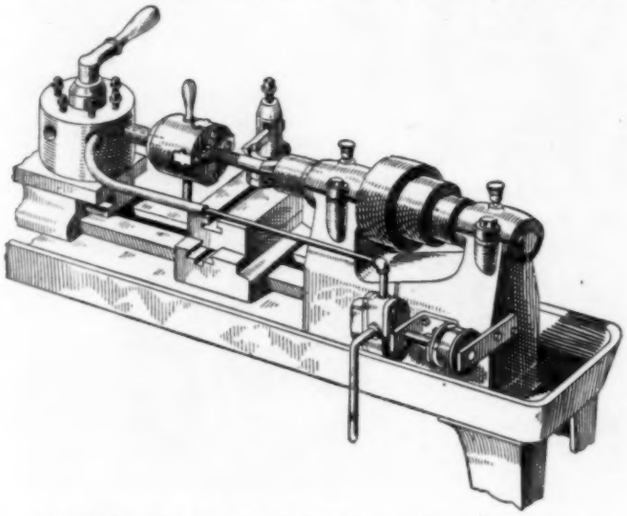
I have also found this method very satisfactory for replacing bearings on small electric motors that have babbitt bushings.

Novel Way of Getting Lubricant to a Die-Head

BY CHARLES H. WILLEY

In cutting small studs upon the screw machine we had experienced considerable trouble from having the die load up and tear the threads, because of the difficulty of getting sufficient lubrication into the die.

The sketch shows how the foreman finally remedied the defect by attaching a rubber tube to the discharge



LUBRICATING A DIE HEAD THROUGH THE SHANK

side of the pump, leading it through one of the turret holes and into the rear end of the die-shank. The flood of lubrication flowing outward washed the chips clear of the die and we had no further trouble.

To Blueprint from Typewritten Sheets—Discussion

BY A. A. BERTRAND

A short article on page 420 of *American Machinist* entitled "To Blueprint from Typewritten Sheets," reminded the writer of an experience he had some years ago with a company which used as a shop form a blueprint made from a vandyke print.

This form was a material or parts list of the machine for the assembly department and its original was a typewritten sheet. It was our experience that no matter how we placed the carbon, we did not get the clear copies we desired, especially as we wanted a dark type on a light background. After considerable experimenting we found that by typing the sheets in a typewriter with a yellow ribbon we obtained a copy that made a very clear print.

The writer has suggested this method to a number of people and they have been very much pleased with the results. To prove this method, it is only necessary to mark a paper with different colored pencils and make a print which will indicate the most satisfactory color.

Taper Pin Turning Attachment

BY L. BOISELLE
Courbevois, France

Having a large number of taper pins of various sizes to make, I worked out and made a taper pin turning attachment to be used on a Brown & Sharpe semi-automatic, which has given very good results as far as cost of production and quality of work are concerned. The illustration shows the attachment fixed on the machine ready for operation.

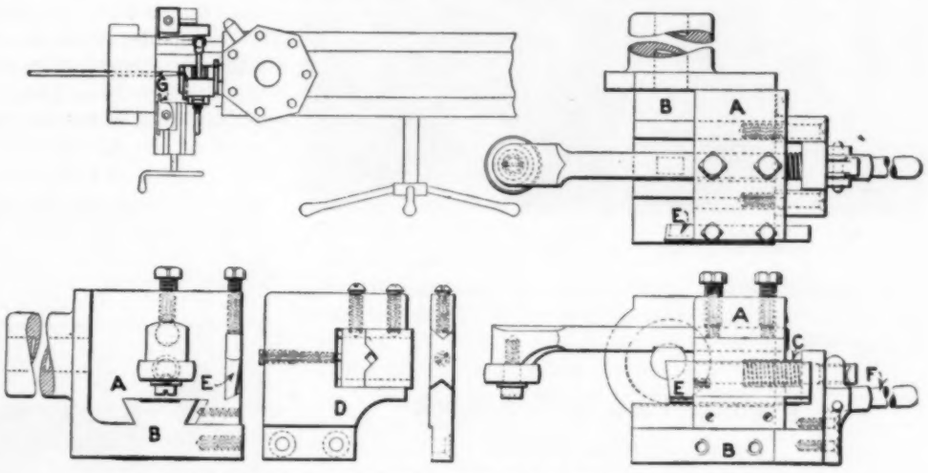
It will be readily seen that the device consists of a tool-carrying block *A* sliding on a guide *B*, the guide having a shank to be fixed in one of the turret holes as shown. The toolblock is provided with a projecting arm, the length of which can be adjusted. At the end of the arm is mounted a roller which by means of a coil spring *C* is kept in contact with a former-plate having the same taper as the pins to be produced. The former-plate is fixed on the back toolblock on the cross-slide.

The stock is fed in the usual way and passes through a steadyrest *D*, the opening of which can be adjusted to suit the diameter of stock used. The steadyrest is fixed on guide *B* by means of two screws.

The tool *E* is held in the toolblock *A* by means of two setscrews. It will be noticed that the tool is placed immediately behind the steadyrest, thus realizing the best working conditions.

A lever *F* is provided to take the tool away from the work to avoid spoiling the tool and marking the taper pin when bringing the turret back. For cutting off, a tool *G* is fixed on the front toolblock on the cross-slide.

Any taper can be obtained by changing the former-plate fixed on the back toolblock.



TAPER TURNING DEVICE FOR B & S SEMI-AUTOMATIC

Safety Device for Paper Cutter

BY C. D. CORWIN
Works Engineer, Corona Typewriter Co.

Articles are frequently published illustrating or describing the means and methods used for making machines safer for the operator. Although it is a fact that many of the readers of these articles are not at the particular time of reading interested so far as the methods may apply to their own problems, it frequently happens that at some future date the suggestion or description does serve as a solution for a problem which has recently arisen. It is with such a thought in mind that the following material is written.

The paper cutter shown in the accompanying illustration is regularly provided with hand operating levers lettered *A*, one at each side of the table. These two levers are rigidly connected to a common shaft and the operation of either lever engages a clutch which drives the mechanism operating the knife.

The treadle *B* when depressed brings down a clamping piece just ahead of the knife in such a manner as to hold firmly the stock to be cut. It would seem, therefore, that this clamping device might serve as a warning device or safety guard in itself. In practice, however, in many instances the treadle and levers are operated in such close sequence (in many cases almost simultaneously), that the holding bar would serve to hold the operator's hand under the descending knife.

To render this machine safer it was decided to make the operation a two-handed one, that is, to make the use of both hands necessary before the cutting operation could take place.

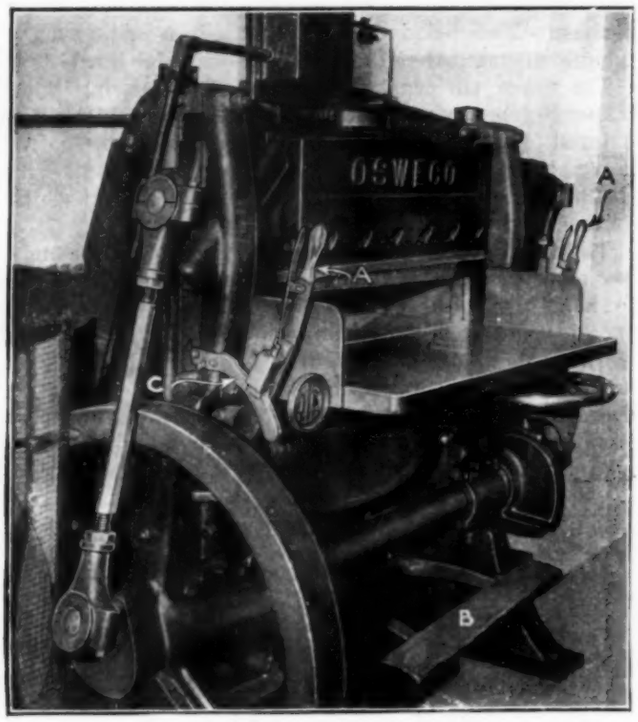
Two arcs lettered *C* in the accompanying illustration were formed of machine steel and bolted to the sides of the main frame in such a position as to hold the two latches, carried by the two regular operating levers. As these two levers were both rigidly connected to a common shaft it was necessary to open both latches before the machine would operate. It was at first

thought that this method of operating would hamper the operator in some cases. This fortunately has not been the case and a much greater sense of protection has resulted.

The Labor Inspectors of New York State of late have been giving considerable attention to print shop equipment. Such protection as just described, however, overcomes much of the objection to that class of machinery.

Although there naturally would be many designs which would render paper cutters safer, the device herein described is simple, is easily applied without changes in the mechanism of the machine and thoroughly accomplishes the purpose aimed at. This device has been in operation about a year and a half and no trouble or dissatisfaction has resulted.

With the utmost care accidents will happen and it



PAPER CUTTER WITH SAFETY DEVICE

is hoped that where paper cutters or machines of similar nature are used this article may be the means of saving a hand or finger.

Peculiar Flaw in Bar Stock

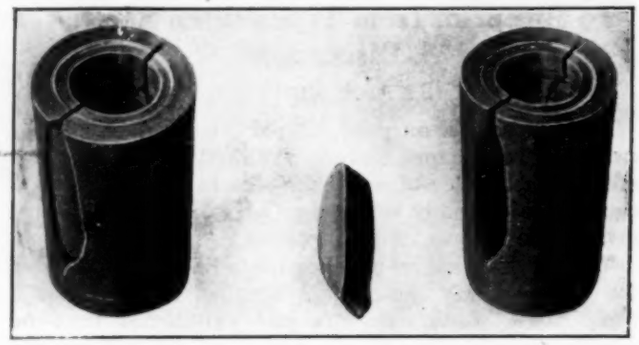
By Milton Wright

The accompanying cut shows a peculiar fault in the structure of a bar of point twenty-five carbon hot rolled steel. The bar in which it was found was one of a number of similar bars included in a shipment from the mill.

The fault is not a crack, but an oblong hole extending clear through the bar and was so completely filled by a plug, or "kernel," before the center hole was drilled as to escape casual inspection. When the bar was in the screw machine being transformed into machine parts, attention was called to the flaw by the continued breaking of drills.

The plug was, of course, cut in two by the drill. One part cannot now be removed from the bar, though it is sufficiently loose to be moved about with the fingers. The other part may be taken out toward the center hole but not from the outside of the bar.

There is considerable speculation as to how the flaw



PECULIAR FLAW IN A BAR OF MACHINE STEEL

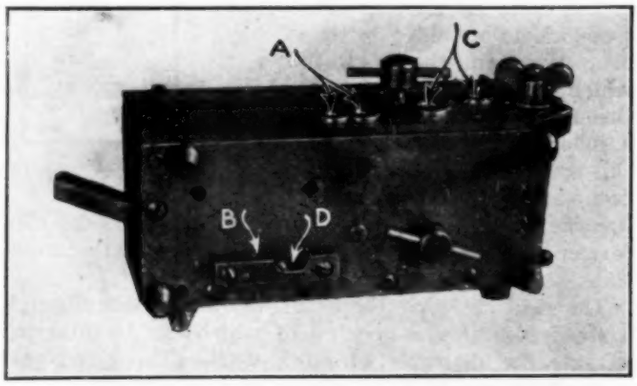
came about. One theory is that a larger bar had been drilled and plugged, and at a later time rolled to the present diameter, which is 2⅜ inches.

The photograph does not show two pieces, but two views of the same piece; one with the loose part removed and one with it in place.

Stop for Setting Drills

By H. E. Crawford

The job of drilling a blind hole is often an uncertain one and we had so many pieces spoiled, due to the fact that the operator either mis-read the scale on the spindle of the machine, or went to sleep and drilled the hole too deep, that we were forced to devise a fool-proof method of setting the drills. The result was that we attached a lug to the side of the jig, as shown in the photograph, at exactly the right height, so that when the operator inserts a drill in the chuck for drilling the two holes indicated by the bushings *A*, he pulls the spindle down as far as it will go and rests the point of the drill in the countersink *B* and then tightens the chuck. When setting drills for drilling the two holes *C*, he rests the point of the drill in the countersink *D* and tightens the chuck. When drilling the piece, he feeds the spindle down as far as it will go, at which point the hole is of the correct depth. A small



JIG SHOWING LUG FOR SETTING DRILLS

hole is drilled through the bottoms of the countersinks *B* and *D*, which prevents dirt collecting in the bottom of the depression. This saves both time and material.

Editorial

Idle Machines that Frequently Pay

TOO many managers seem to overlook the fact that the net cost of an article is what counts. They let side issues block their view of the real issues. One phase of this attitude is pointed out by John R. Godfrey in another column.

It is unfortunate, but true, that too many managers have certain notions, good in themselves but not the only factors to be considered. Keeping machines busy is one of these notions. An excellent idea in itself, it may easily lose money for the firm unless the net cost is carefully considered.

No one interested in economical management likes to see machines standing idle. But the man who criticizes the management of a shop that has idle machines is frequently guilty of that sort of snap judgment that proclaims him as being superficial instead of keenly observing. There are many cases where a machine that stands idle half the time is the best investment in the shop.

It is particularly important that this point be carefully thought out and understood at this time. There are new machines on the market with greater capacity than ever before, perhaps greater capacity than you can utilize at present. But before you decide against purchasing, figure out the net cost per piece, including idle time of course, very carefully. You are likely to find a net saving. If you do, there are many reasons for buying, and buying now.

The industry needs encouragement in every legitimate way. Any machine which will show a net saving on present production, should be bought now, if it can possibly be afforded. The man whose policy is to sit tight and buy only what is absolutely necessary is hindering the return of prosperity for himself as well as for everybody else.

Justice Works Both Ways

SPEAKING before the Plainfield Section of the American Society of Mechanical Engineers, A. L. DeLeeuw, whose name is familiar to readers of *American Machinist*, declared that the only basis on which satisfactory industrial relations can be based is justice. Mr. DeLeeuw went on to say that acts of injustice are quite as frequent on the part of the employees as on the part of the employers and in some trades far more frequent.

The shortcomings of the employers have been laid bare by the old muckrakers, the labor leaders and the modern sentimental investigators, and their duty has been pointed out with careful attention to detail. They have been admonished from the pulpit, villified by the demagogs and the radical press and investigated by governmental authority. If their way is not clear before them it is no fault of those whose welcome duty it is to tell the other fellow how to run his business.

The employee on the other hand has fared much better in his treatment by the uplifters. The principal effort in his case has been to enumerate and emphasize his rights with but the most casual attention to his duties. So one-sided have been the endeavors of his sympathetic friends and self-appointed representatives that he could be hardly be blamed if he completely lost sight of the fact that he has duties to perform as well as rights to claim.

The right to strike has been claimed so often and so vociferously by labor leaders that the right to work as defined by the Kansas Court of Industrial Relations and other judicial bodies has been somewhat neglected. The duty of rendering a fair day's work in return for a fair day's pay is one that should not be avoided, and cannot be in the long run if we are to continue our existence as a community.

Perhaps the insistence of the courts that this duty on the part of the employee is a very real one, is one of the reasons why Mr. Gompers recently expressed the devout hope, "God save labor from the courts!" If he and the other leaders of organized labor had been wise enough to spend a quarter of the effort in pointing out the duty of the workman to give a fair return for his wages, that they have spent in telling him about his rights, there would probably not be the need to fight for the threatened rights that undoubtedly exists in some quarters.

The average employee is just as anxious to play fair as the average employer. If each should subordinate everything else in an affort to deal justly, industrial peace would be in sight.

New Things That Are Old

THE replies to the query by I. B. Rich regarding the use of serrated axle ends for preventing the crank from turning, emphasize the salient facts. One, the difficulty of tying up events and dates in the average mind, and the other the time and money we spend in reinventing old devices.

Few men have memories which retain many details of events and we must apparently depend upon the printed page for authentic data as to the use of different devices. The difficulty is in knowing where to look for the information desired. The loss which this lack of knowledge entails can hardly be estimated, for thousands of hours and dollars are spent every year in working out some mechanical problem which has been used, perhaps many times, and lost sight of because the need for it temporarily disappeared.

Knowledge of what has been done before would also have a great effect on the granting of patents. Many devices and processes which have been used in the past have never been patented, so that the patent office has no record of their existence.

It has been suggested that the colleges could do a good work by collecting, filing and teaching, to some extent, the history of machine design and of machining processes. Such data would be of great value to all manufacturing establishments and they could well afford to pay for the information so obtained. It is not an easy task, but it is one well worth thinking over.

Shop Equipment News

Colburn Heavy-Duty Vertical Boring and Turning Mills

The Colburn Machine Tool Co., 1038 Ivanhoe Road, Cleveland, Ohio, is now placing on the market a line of heavy-duty vertical boring and turning mills that have been the subject of test and experiment for a number of years. The sizes include 42 in., 48 in., 54 in., 62 in., 72 in. and 84 in. The chief characteristics of these mills are rigidity and features that permit easy, rapid and safe operation. Among them are single lever control for feed and rapid traverse of head and ram; automatic gravity lubricating system; forced lubrication of angular and vertical spindle bearings; spring counter-weighting of rams and turret slide; close adjustment ratchets, carrying micrometer dials, mounted on the heads; friction disk clutches to raise and lower the cross-rail; single pulley drive; table guard; ball bearing equipment; narrow guide bearings on cross-rail. Front and rear views of the 42-in. machine are given in Figs. 1 and 2, which also serve to show the distribution of metal and the depth of cross-rail and housing-tie.

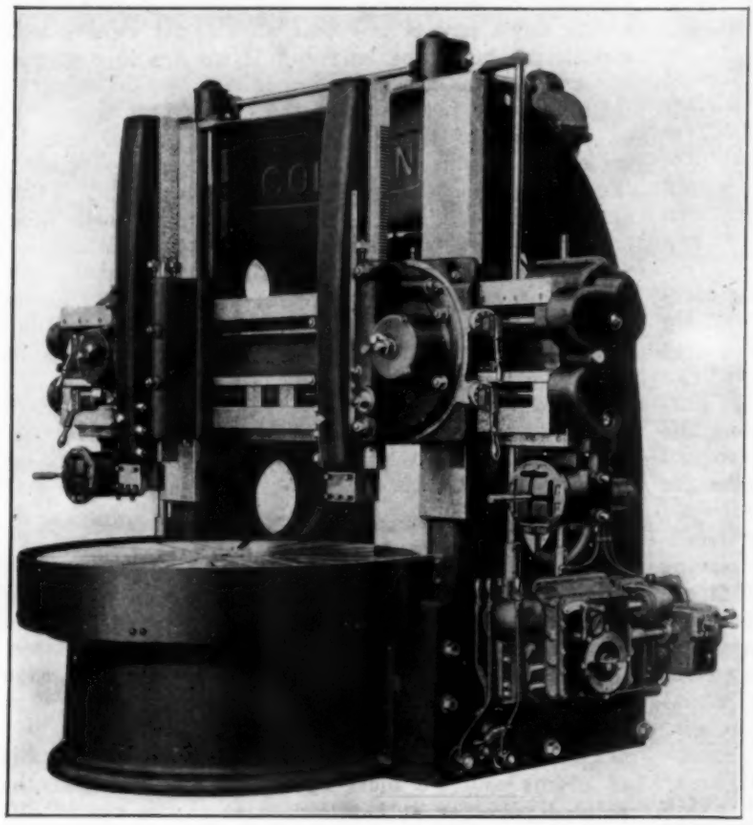


FIG. 1. COLBURN 42-IN. HEAVY-DUTY TWO SWIVEL HEAD BORING AND TURNING MILL

Specifications, 42-in. machine: Actual swing, 44 in.; diameter of table or chuck, 40 in.; height of table from floor, 33 in.; maximum distance under cross-rail, 36 in.; maximum distance under turret, 41 in.; swivel of heads either side of vertical, 45 deg.; table speeds, 12 changes, 2¼ to 70 r.p.m.; maximum ratio of gearing, 195:1; minimum ratio of gearing, 6¾:1; horizontal and vertical feed, 16 changes, 0.006 to 1.000 r.p.m.; thread-cutting attachment, 2 to 24 threads per inch, including 11½; vertical travel of rams, 30 in.; vertical travel of turret slide, 26 in.; diameter toolholder shanks, ram 3 in.; turret, 2½ in.; maximum size tool accommodated, 1¾ in. square; diameter turret, 13 in.; length of cross-rail, 97½ in.; width front face of cross-rail, 20 in.; vertical bearing of cross-rail on housing, 20½ in.; length horizontal bearings of saddles on cross-rail, 24 in.; width face of housing, 7 in.; driving pulley, 20 in. diameter for 5-in. double belt; speed of driving pulley, 440 r.p.m.; motor, 10 hp., 1,200 r.p.m.; net weight, 20,000 lb.; floor space and height, 108 in. wide, 97 in. front to back, 100 in. high; weight boxed for export, 23,000 lb.; boxed for export, 4 cases, 414 cubic feet.

The table is cast solid, that is, without being cored on the under side. Four sets of parallel T-slots are provided for holding faceplate jaws or fixtures. There are eight radial T-slots. The table spindle has a self-centering angular bearing and two vertical bearings. It is ground and is provided with spiral oil grooves cut on the vertical bearing surfaces. The table guard is of heavy sheet steel. There is clearance between table and guard so that chips may fall to the floor. Openings in the guard are provided for quick access to chuck screws on machines equipped with independent, built-in, four-jaw chucks. Twelve table speeds in geometrical progression are available. They are obtained by means of sliding gears and hardened positive clutches. Speeds are controlled by the operator from his regular working position, since both back gear lever and change gear lever are located on the front right-hand side of the machine. Gear shifts are accomplished by means of a cam arrangement, shown on the rear view of the assembled machine, Fig. 2. On each side of the machine, at the front, is a starting and stopping lever. Continuing the motion by which the clutch is disengaged, applies the brake.

Four of the twelve changes of speed are provided by the speed change gear box, or primary unit, and three by the secondary unit, located within the base of the machine. Power is transmitted through a single pulley with disk clutch. All gear shafts are mounted on ball bearings. Driving gears are held in position by keys and spacers.

Except where phosphor bronze gears are necessary, steel gears are used. Drive gears are stub tooth, heat-treated, except where size makes heat-treating impracticable.

The cross-rail is of the narrow guide bearing type. There are no projecting crank handles and clutches, which adds to the safety of the operator. Ball thrust bearings are provided at the ends of the crossfeed screws and vertical feed worm. Raising and lowering of the cross-rail is accomplished by engaging a multiple disk friction clutch running in oil, making unnecessary the use of tumbler gears, chains, sprockets, etc. The elevating device is shown in Fig. 3. The operation is by power, independent of the table drive.

The heads are independent in feed and traverse in

both directions. Each is provided with a feed box and a single lever control. Either head can be traversed to the center of the table for boring, where it is located by a positive hardened stop. Ratchets, mounted on the saddles, make possible close adjustments of the heads. Regular clamping bolts and additional long bolts are used to clamp the swivels to the saddles when the ram is in a vertical position. The added strength due to the long bolts is apparent.

Each ram has three taper gibs and an inset high-carbon steel rack running its entire length. The rams can be raised far enough that the bottom of the tool-holders will be above the lower edge of the cross-rail. They can be swiveled through 45 deg. either side of the vertical position. Swiveling is accomplished by means of a worm and segment, which makes setting easy and acts as a safety lock to prevent tipping when the clamping bolts are loosened.

Counterweighting of rams and turret slide is accomplished through spiral springs. This arrangement does away with weights, cables and sheaves. It prevents any interference with crane hook when brought directly over the center of the table. The spring can be adjusted to any desired tension, by means of a ratchet, as shown in Fig. 4.

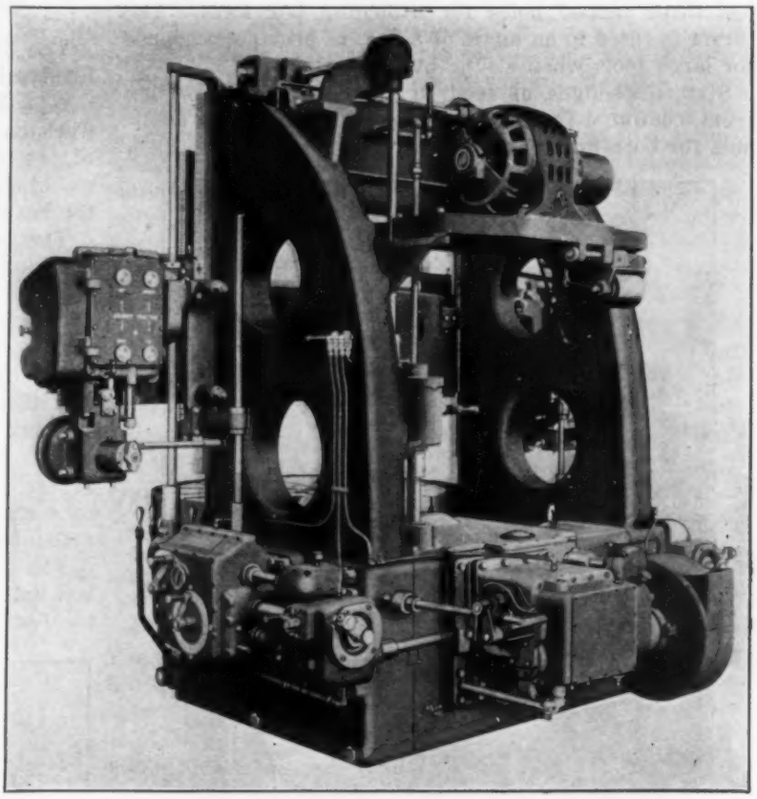


FIG. 2. REAR VIEW OF 42-IN. MACHINE

An especially noteworthy feature of the machine is the single lever control for head and ram of both feed and rapid traverse. The control for the right-hand ram is shown in Fig. 5. It is so designed that the lever is always thrown in the direction of the movement desired. When either feed or rapid traverse is engaged, the other is disengaged. Each of the four slots of the control plate is used for engagement of a feed and a rapid traverse. In each case the directions of feed and traverse are opposite. Running the slide to the limit of traverse without moving the lever to neutral position will cause the clutch to slip without damage to mechanism.

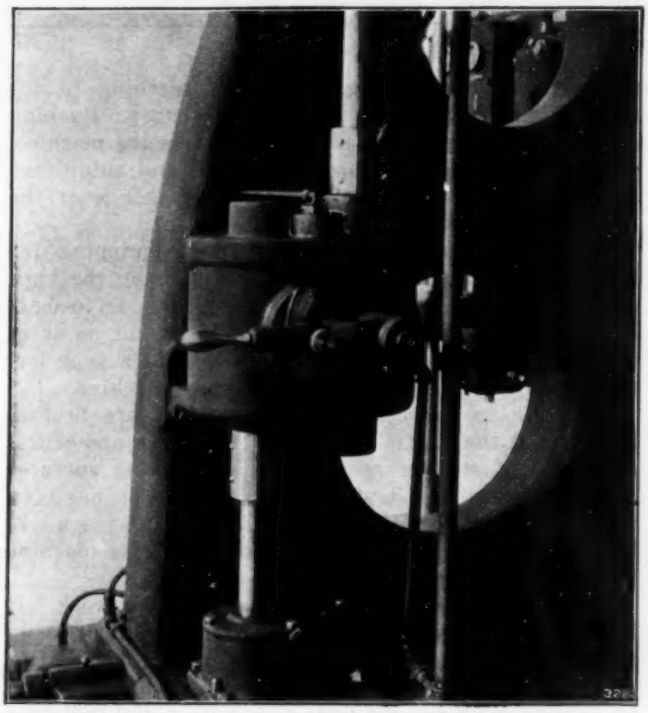


FIG. 3. CROSS-RAIL ELEVATING MECHANISM

Rapid traverse is obtained with the table in motion or at rest. The movement is at the rate of approximately 12 ft. per minute. Final adjusting ratchets for vertical and horizontal movements are mounted on the heads, a position making it unnecessary for the operator to leave his working position. They carry adjustable micrometer dials, reading in thousandths of an inch.

The secondary speed box forms an oil reservoir from which the oil is pumped to a cored chamber in the top brace. From there it flows to the feed cases, feed multiplying units, primary drive, spindle bearing and elevating device, passing through sight feed oilers on each side of the machine. The clutch boxes at the ends of the rail are filled with oil to a level indicated by an oil cup. Oil is pumped from the tank in the top brace to the outer edge of the angular spindle bearing and is fed by gravity down the vertical bearings back to the reservoir.

Power is applied through a single pulley mounted on ball bearings. A constant speed motor is mounted on a bracket between the housings at the rear of the machine and is belted to the driving pulley. An idler pulley maintains the proper belt tension. Radial and thrust ball bearings are used throughout the drive, in the clutch pulley and in the rapid traverse drive.

Threads of 4, 8 and 16 per inch can be cut without extra equipment. A thread-cutting attachment can be furnished to cut threads of from two to 24 per inch, including 11½. No changes in the feed mechanism are necessary.

A five-side turret head can be supplied. Each side

has three tapped holes for attaching box tools. The turret is tilted to an angle of 8 deg. to provide clearance for large tools when swung over the slide.

Sixteen changes of feed in geometrical progression from 0.006 to 1 in. per revolution of the table are available for both horizontal and vertical movements. Each

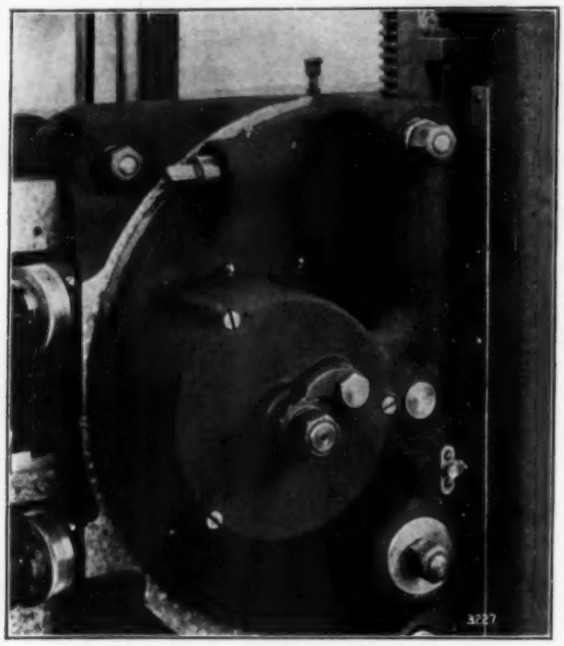


FIG. 4. SPRING COUNTERWEIGHT FOR COUNTERBALANCING RAM

head is independently controlled. All gears are steel.

The design includes among the safeguards for the operator: Encasement for all moving parts at the ends of the cross-rail; guards for driving pulley and clutch; table guard; friction feed clutches; an interlocking arrangement making it impossible to start the machine before the driving gears are fully in mesh, and preventing the making of speed changes until the clutch pulley has been disengaged.

The machine can be equipped with revolving center head for boring, reaming and facing operations on such

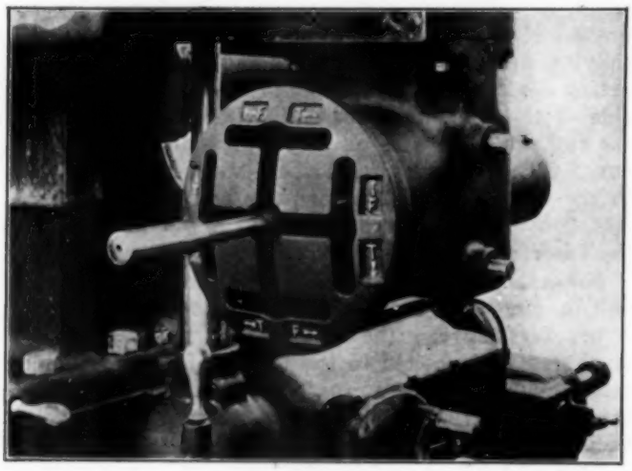


FIG. 5. SINGLE LEVER CONTROL FOR FEEDS AND TRAVERSE OF RAM

pieces as flywheels and pulleys; grinding spindles; milling spindles; cutting lubricant outfits; cross taper and forming attachment, and pulley crowning attachment.

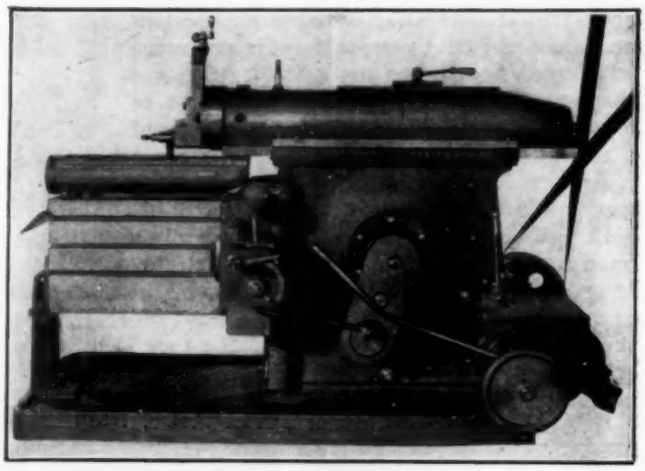
Kelly 32-inch Shaper

The 32-in. crank shaper shown in the accompanying illustration is a recent development of the R. A. Kelly Co. of Xenia, Ohio. The view shows the machine at work on the ram of a 14-in. shaper and gives an idea of the difference in size between the 14- and 32-in. machines. The 32-in. shaper is intended particularly for heavy duty, such as in railroad and forge shops.

The extreme stroke is 33 in., with a vertical movement of the table of 12½ in. and a cross traverse of 30 in. The table is of the revolving type, and work may be clamped on either side or the top. A special feature is the table support.

The feed mechanism on the machine is very simple and all parts are enclosed in a box. To change feeds, it is not necessary to touch any moving part. The feed cannot be caused to operate during the cutting stroke of the ram. The direction of the feed is controlled by a straight knurled lever on top of the box, and the amount of the feed by the lever on the side.

The gear box is patterned after an automobile gear box, and has four changes of speed, which are engaged by a ball lever on top of the box. The clutch and brake



KELLY 32-INCH SHAPER

are controlled by a long steel lever reaching to the operator's position at the front of the shaper. Pushing this lever in engages the clutch and starts the machine, while pulling it out releases the clutch and automatically engages the brake. By the use of this lever the ram may be brought to a stop at any point.

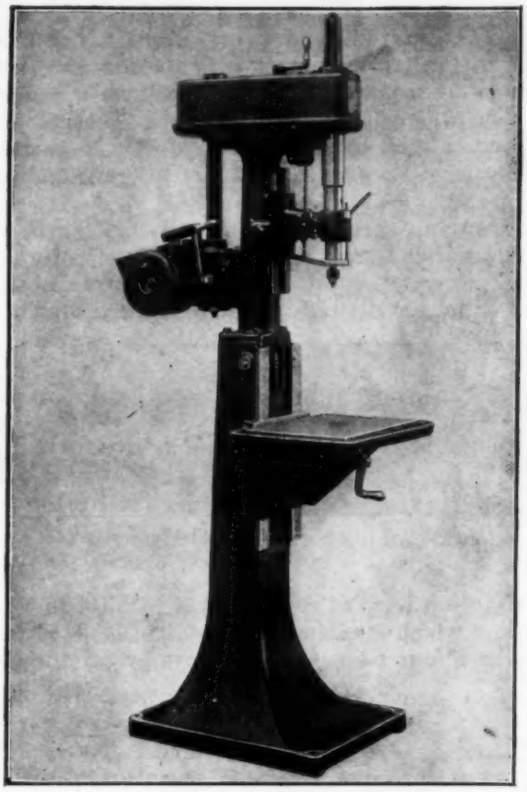
The only changes to be made when equipping for motor drive are bolting a bracket to pads on the back of the shaper and putting a gear on the drive-shaft instead of the pulley. All machines are built so as to be easily fitted with motor equipment, and a gear box may be quickly installed on a cone-driven machine.

All holes in the column and gear box are bronze-bushed and the shafts hardened. All gears are helical and made of steel or semi-steel. The sliding surfaces are provided with felt wipers, and lubrication has been made nearly automatic. Places difficult to reach are lubricated through tubing. The weight of the machine as shown is 6,500 pounds.

The machines are built for close, exacting work. It is stated that in a recent test, the machine very easily took a cut 1 in. deep with ⅛-in. feed in cast iron. After this test, the table was brought to its lowest and then to its highest position, and tests aken with a dial indicator showed that no corner was out 0.001 in.

Fosdick 13-inch "Superspeed" Drilling Machine

The sensitive drilling machine illustrated herewith has recently been added to the line of the Fosdick Machine Tool Co., Cincinnati, Ohio. It is built in a



FOSDICK "SUPERSPEED" DRILLING MACHINE

13-in. size, in two types, bench and pedestal, and in combinations of from one to eight spindles. The capacity is for drills up to ¾ in. in diameter in steel, iron or brass.

With the driving pulleys running at 1,750 r.p.m., three spindle speeds of 5,700, 8,000, and 12,000 r.p.m. are available, although other speeds to suit conditions may be substituted. All revolving members are equipped with annular ball bearings and dust-proof metal oil retainers, and the only revolving member exposed is the drill chuck. The helical-gear drive reduces vibration and noise. Because of the gears and the flat endless belt, the danger of drill breakage at maximum speeds is said to be greatly reduced.

The outstanding feature of the machine is the speed-changing arrangement, by which a single turn of a handle automatically releases the belt tension, shifts the belt first from the larger to the next smaller step on one cone pulley, and then by a similar movement from the smaller to the next larger step on the other cone. The belt tension then automatically adjusts to the new position. An aluminum guard, which completely encloses the belt and cone pulleys, may be lifted off without removing or loosening bolts or nuts, thus enabling the operator to install a new belt very easily.

In the pedestal-type machine illustrated herewith a very large floor area is provided. The elevating table is of the quick-acting counter-balanced type, with the clamping handle in front. The traverse is 10 in. Both the elevating and the bench tables are surrounded by liberal chip and lubricant channels.

The head has a vertical traverse of 6 in. and is counterbalanced to prevent dropping when unclamped. The spindle feeds to a depth of 3 in. and has an adjustable depth stop. It has an adjustable gravity counterbalance which employs no springs and which may be set to automatically return the spindle. The feed lever is adjustable to suit the operator. Opposite the feed lever is the quick-return handwheel, which enables the operator to position, feed, or return the drill with either hand.

The belt guard and shifter can be adjusted to receive the belt from any angle. Motor drives are either belted or direct connected, with a ½-hp. motor mounted on the machine. The regular equipment includes a No. 1A Jacobs drill chuck on each spindle. The bench-type single-spindle machine weighs 225 lb., and the pedestal type 464 pounds.

Brown Direct-Reading Resistance Thermometer

A direct-reading resistance thermometer, shown in Fig. 1, has recently been placed on the market by the Brown Instrument Co. of Philadelphia, Pa. The thermometer is intended for industrial use, and particularly for installations where it is necessary to know accurately a high temperature when only a small range is required. The large size of the divisions for each degree permits of more accurate reading than when the range on the scale is from zero.

The principle on which the operation of the thermometer is based is the change in electrical resistance occurring in metals with a change in temperature. This change can be accurately measured, and a scale calibrated to read directly in degrees of temperature. The coil of wire which changes in resistance is usually of nickel for temperatures up to 300 deg. F., and of platinum for temperatures up to 1,800 deg. This coil or "bulb" can be very small; a nickel wire bulb can be supplied with an active part 1 in. long and ⅛ in. in diameter, and the protecting tube need have an outside diameter of only ¼ inch.

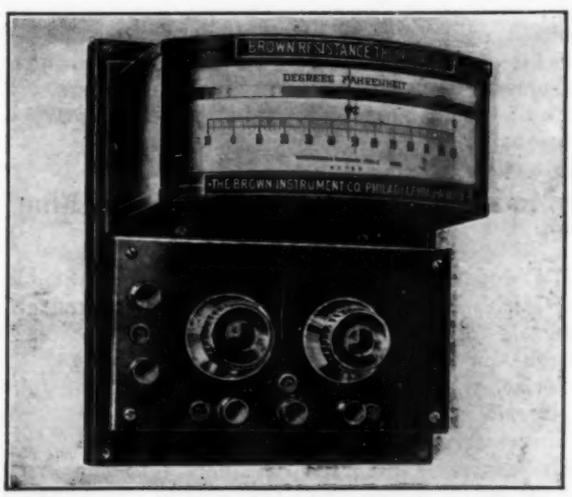


FIG. 1. BROWN DIRECT-READING RESISTANCE THERMOMETER

Bulbs can be furnished for all types of uses, whether for high or low temperatures or for use in chemical

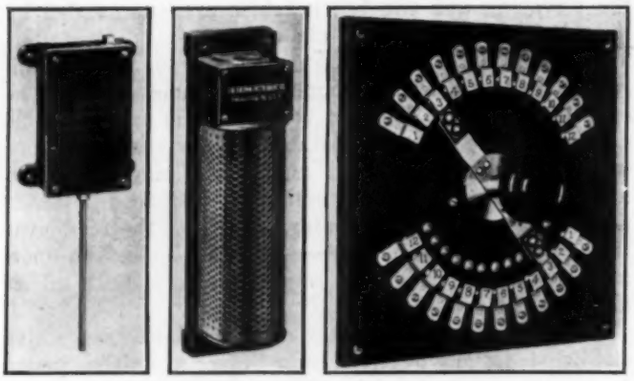


FIG. 2. BROWN BULBS AND SWITCH

processes. The view at the left of Fig. 2 shows a bulb for use in damp locations, while the view in the center shows the style ordinarily employed in rooms where no special conditions exist to disturb the operation. The latter type of bulb can be employed for public buildings, where accurate registration of the temperature is required.

The switch shown at the right of Fig. 2 enables connecting the instrument to any number of these resistance thermometer bulbs. For use in dry kilns, the instrument can be employed to measure both temperature and humidity, one bulb being subjected to the air temperature only, and the second bulb being covered by a wick connected to a tank of water.

Three wires lead from each bulb to the instrument, and changes in temperature along the wiring do not affect the reading. The length of the wire is immaterial, and the bulbs can be placed up to 1,000 ft. distant from the instrument when using 14-gage copper wire, or up to 2,500 ft. with 10-gage copper wire.

In checking the instrument for the zero reading in order to determine its accuracy, it is not necessary that the pointer be brought down to zero, since most scales are not provided with such a reading. However, the left-hand knob is turned to *Z* and then to *S*, to check the instrument with a standard resistance. When the knob is placed in the third position, the instrument is operated directly from the temperature bulb. The rheostat controlled by the right-hand knob on the instrument is used for adjusting the voltage. This check of the instrument is stated to be necessary only occasionally.

Modern "Quickgrip" Drilling Machine Table Vise

The Modern Machine Tool Co., 401 Water St., Jackson, Mich., has recently taken over the manufacture and sale of the "Quickgrip" table vise from the Sprague-Hayes Manufacturing Co. of Detroit, Mich. The vise, which was described on page 490, Vol. 51, of *American Machinist*, is intended for use on upright drilling machines.

The device is secured permanently to the machine and serves as both a table and a vise. When the vise is closed, the work-carrying table is 16 in. in diameter. A maximum jaw opening of 8 in. is provided, one jaw being moved by a 1¼-in. screw. The use of the device saves the time taken in mounting and removing a vise from a plain table. Either a plain, flat table or a vise or both together are quickly available.

Bath Ground Tap with "Sharpening Face" Flutes

A line of carbon and high-speed steel ground taps such as shown in Fig. 1 is being introduced by John Bath & Co., Worcester, Mass., incorporating a feature designated as the "sharpening face" flute.

As may be seen in the drawing, Fig. 2, which shows a section of the tap in contact with the grinding wheels, the shape of the flute is such as to leave a projecting face upon which is the cutting edge. The actual cutting face of each tooth is undercut by the round-face grinding wheel to give the effect of top rake and insure a clean and free-cutting tooth.

The taps are ground to size and final shape after hardening, thus removing all decarbonized material and eliminating errors due to distortion in hardening. The thread is not eccentrically relieved in the ordinary way,

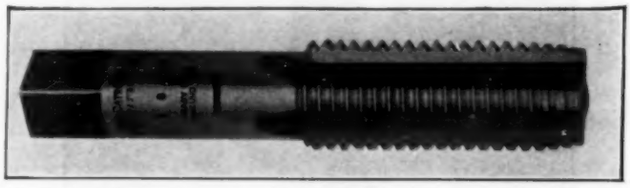


FIG. 1. BATH GROUND TAP WITH "SHARPENING FACE" FLUTES

but is given a form of relief that is peculiar to this tap alone and which is claimed to result in longer life.

The first four teeth, which remove by far the largest

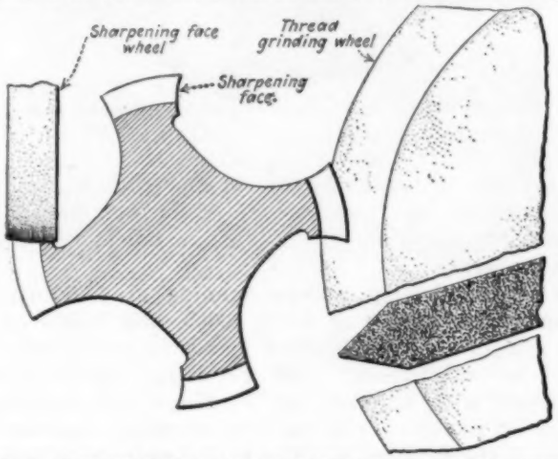


FIG. 2. SECTION OF TAP IN CONTACT WITH GRINDING WHEELS

portion of the metal from a threaded hole, are eccentrically ground, but the remainder of the cutting part is concentric and the outside diameter uniform. Beginning with the fifth tooth and continuing for four or five turns, the pitch diameter is constant and to exact nominal size. From this point, however, the pitch diameter falls away in a uniform taper toward the shank, where at the last turn of thread it is 0.00125 in. under size.

The advantages claimed for this tap are that the gradually lessening diameter reduces the tendency to bind and makes a free cutting tool; and that, because of the concentricity of the thread, regrinding the cutting face may be carried to any extent without diminishing the diameter of the tap or otherwise impairing its accuracy. The life of the tool is thus greatly prolonged.

Horton Differential Chuck

The E. Horton & Son Co., Windsor Locks, Conn., has developed a chuck for turret and engine lathes in which the power of the machine is utilized to close the jaws and grip the work, doing away with the necessity for wrenches and lessening the time and labor of setting up as compared with that required with a manually operated chuck. The chuck is of the scroll type and may be fitted with any of the standard Horton chuck jaws for internal or external holding.

The scroll-plate is considerably thicker than in the regular scroll chuck, and instead of the usual teeth of a bevel gear upon its periphery, as in wrench-operated chucks, the back face is counterbored and in the recess thus formed an internal gear is cut from the solid metal. The absence of teeth upon its periphery allows the scroll-plate to take its bearing within the body of the chuck upon its outer circumference, instead of upon the narrower and smaller diameter of its bore.

Directly back of the scroll-plate in the assembled chuck is an annular steel ring, attached to the body of the chuck as described later. Upon the inner circumference of the ring are cut the teeth of an internal gear similar to the one in the scroll-plate but slightly larger in pitch diameter. This ring is called the "backing gear."

Turning freely upon a large ball bearing mounted on the hub of the chuck is a ring, known as the "handwheel," of the same outer diameter as the chuck body. This wheel may be seen in Fig. 1, where it appears as the knurled portion of the body, and separately in Fig. 2 with the backing gear and differential pinions in their respective places.

Five pairs of pinions are mounted on studs shouldered into the inner face of the web of the handwheel. Of each pair, one pinion is slightly smaller in pitch diameter than its mate and meshes with the internal gear of the scroll-plate, while the larger one meshes with the backing gear. The two pinions of each pair are pinned together as one piece, the entire mechanism thus forming in effect an epicyclic train.

Considering for the moment that in the assembled chuck the backing gear is rigidly attached to the chuck body, it is obvious that if the handwheel (carrying with it the pinions) is rotated in a forward direction upon the stationary chuck, the pinions will run freely around in mesh with their respective internal gears. However, because of the differential ratio, the internal gear that is part of the scroll-plate will turn slowly backward with relation to the stationary chuck body.

Similarly, when the chuck is running forward with the lathe, if the hand is pressed upon the knurled part of the handwheel and its rotative movement stopped, the differential action of the epicyclic train will cause the scroll-plate to creep slowly ahead of the revolving chuck and thus close the jaws.

This differential action may be made in any desired ratio. In practice, it has been found desirable to make it about 9 to 1, causing the chuck jaws to move radially $\frac{1}{32}$ in. for each full revolution of the handwheel upon the chuck body. When mounted upon a machine, as a lathe, turret, or screw machine, a lever and brake are supplied to be attached to the headstock, thus providing means by which the pressure may be applied to hold the handwheel stationary while the rotation of the chuck automatically closes the jaws upon the work.

Theoretically the backing gear should be firmly attached to the chuck body. Actually it is held to the latter by studs entering short curved slots upon its periphery in such manner as to permit a certain amount of lost motion or "backlash" in the mechanism. Thus a quick forward movement of the handwheel will deliver a hammer blow upon the train, and will effectively release the most obstinate grip. This rocking movement of the handwheel may be repeated, if necessary, until the chuck releases, when the wheel will spin rapidly forward without material resistance.

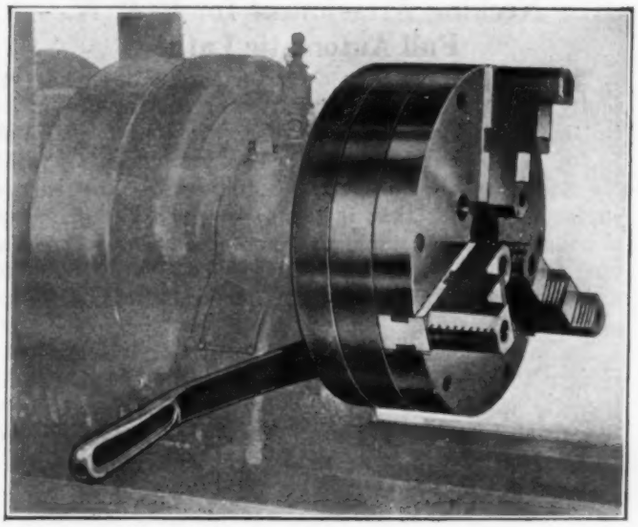


FIG. 1. THE HORTON DIFFERENTIAL CHUCK

Except for the manner of operating it, the chuck is the same as the standard steel-bodied Horton chucks, the jaws being interchangeable. Though it has the appearance of greater width, the new chuck has no more overhang than the standard chuck; all of the additional mechanism is back of the faceplate.

As the power to move the scroll-plate is delivered at five equally spaced points around the circle of the plate, the pressure is balanced, and all energy applied to the handwheel is utilized to move the jaws. As all moving parts except the scroll-plate are mounted upon ball bearings, the handwheel turns easily and may be spun rapidly backward or forward to open or close the jaws any considerable distance.

The chuck holds any piece within the range of standard chucks of similar sizes without adjustment or change of parts. All parts remain stationary with relation to the chuck body except when operating the jaws; therefore, there are no frictional losses or wearing of parts when the chuck is running. The chuck is available in the 13-in. size, and will be made in 9-in. and 16½-in. sizes.

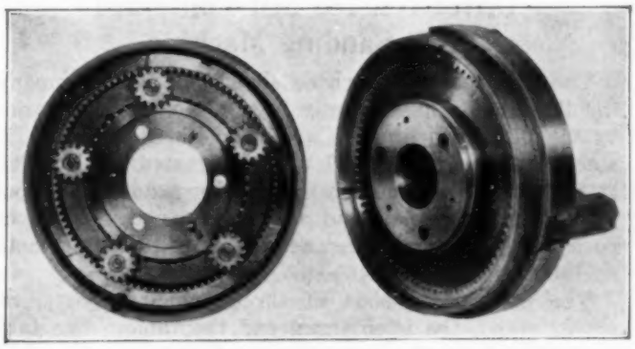
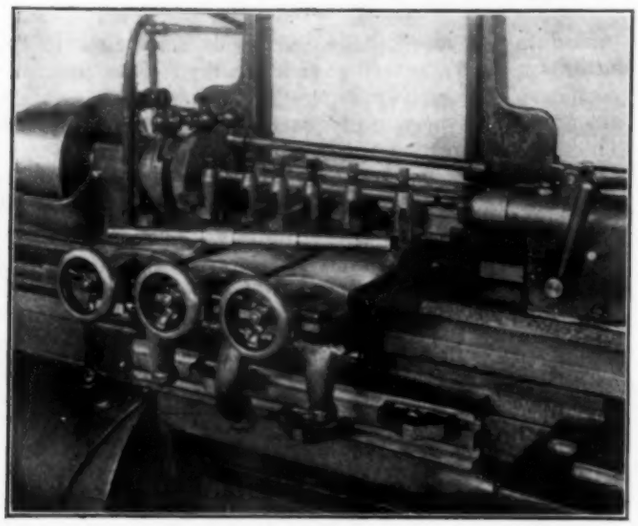


FIG. 2. OPERATING MECHANISM OF THE CHUCK

Necking Attachment for P. & W. Full Automatic Lathe

The Pratt & Whitney Co., Hartford, Conn., has recently brought out a necking attachment for use on its full automatic lathe such as described on p. 897, Vol. 55, of *American Machinist*. The attachment is used for squaring shoulders or necking below the turned surfaces of work that is being prepared for grinding, although it is adaptable to other operations where the crossfeed can be utilized. It can be readily removed and the regular carriage with its actuating parts applied to the lathe.

The attachment consists of multiple carriages that replace the regular carriage of the lathe. One, two or three of these carriages may be adjustably clamped to the front way of the bed. They carry regular toolslides, and provision is made for employing multiple toolposts. Adjustment for depth of cut is made by the handwheels shown in the accompanying illustration



NECKING ATTACHMENT ON P. & W. LATHE

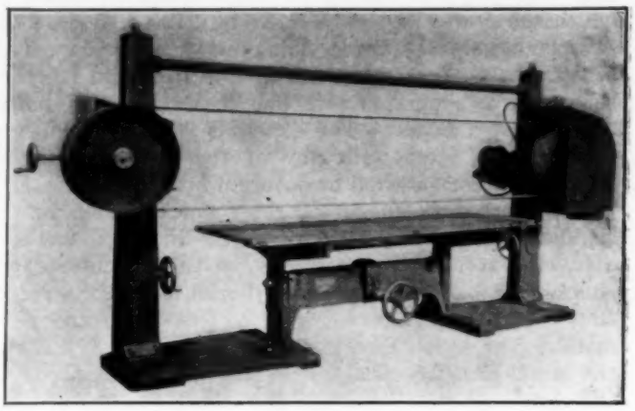
mounted on screws with graduated dials reading in thousandths of an inch.

The cross-slides are actuated, through the medium of roll-carrying arms, by the adjustable cams mounted on a cam carrier that is reciprocated longitudinally by the main feed cam of the machine. These cams can be adjusted to provide any sequence of the cross movements, or all slides may be moved in unison, depending on the nature of the work. Suitable oil distribution is provided, and all of the automatic functions of the lathe are retained.

Oliver No. 183 Self-Contained Belt Sanding Machine

The belt sanding machine shown in the accompanying illustration has recently been placed on the market by the Oliver Machinery Co., Grand Rapids, Mich. The machine is self-contained and designated as No. 183. It is adapted particularly to rapidly sanding and polishing straight, flat and irregular wooden surfaces, such as on large patterns, as well as to polishing metal surfaces.

The machine consists of three principal parts, the power stand, the idler stand and the table. The table is fastened to the base plates of the stands, which are connected overhead by a rigid bar. The sand belt pulleys run on ball bearings that are provided with individual adjustment vertically. The bearing housings



OLIVER NO. 183 BELT SANDING MACHINE

are mounted on gibbed, graduated ways and are moved by means of handwheels operating through bevel gears and screws.

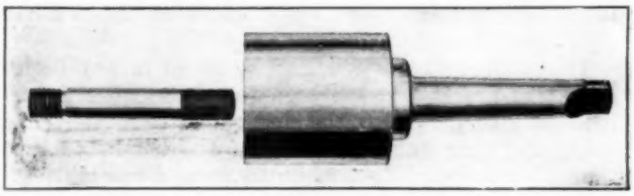
The arrangement of the parts of the machine is convenient for the operator, so as to enable quick work. The spokes in one pulley are guarded and the other pulley is entirely enclosed in the exhaust hood. The table rolls on ball bearings, and not on ball-bearing rollers. No gravity idlers are employed. The table is 96 in. long and 32 in. wide. It travels 36 in. horizontally and adjusts 14 in. vertically. The belt is about 31 ft. long and any width up to 10 in. may be used.

With the slow-speed motor drive, the motor is directly connected to the driving pulley. A high-speed motor may be geared to the pulley, as shown in the illustration. The pulleys are 24 in. in diameter and have 10-in. faces. They are rubber faced and run at 600 r.p.m. The large diameter of the pulleys requires that the belt be bent but little when passing around them, so that the life of the belt is increased. By means of a reversible switch, the belt may be caused to run in either direction.

The machine will take work of any length, and sand to the center of a 72-in. circle. It will hold work 42 in. high on the table, and by unbolting the table, work 66 in. high from the floor can be accommodated.

Jarvis Self-Opening Stud Setter

The Geometric Tool Co., New Haven, Conn., has recently placed on the market the Jarvis self-opening stud setter shown in the accompanying illustration. The tool is simple in design and provides a quick grip and



JARVIS SELF-OPENING STUD SETTER

release for the work. The parts are hardened and the tool is made to withstand long service.

The setter is made in three sizes. The No. 1½ size

has a capacity up to ½-in. studs, and is provided with a No. 2 or 3 Morse taper shank. The No. 2 size has a capacity up to ⅞ in., and Nos. 3 or 4 taper shanks. The capacity of the No. 3 size is up to 1¼ in., and Nos. 4 or 5 shanks are used. Special sizes of taper shanks can be furnished to suit particular needs, and special sizes of jaws can be supplied.

Van Keuren Thread-Measuring Wires

The Van Keuren Co., 362 Cambridge St., Boston, Mass., has recently added to its line various sizes and sets of wires for use in the measurement of screw threads, angles and profile gages. The measuring wires are made by methods similar to those used in the manufacture of gage blocks, so that wires which are practically perfect as to roundness, uniformity of diameter and size are said to be produced. The wires are standardized by light waves against standards certified by the National Bureau of Standards at Washington, D. C., so that their accuracy is assured.

The wires are 1¾ in. in length and are lapped the full length, thus giving a long wearing surface. They are usually furnished without handles or suspension ends,

VAN KEUREN THREAD-MEASURING WIRES

which can be supplied when desired. The wires provided for screw-thread measurement are known as "best size" wires; that is, wires of the theoretical diameter to touch on the pitch line or at the pitch diameter of a perfect thread. By using the "best size" wire for each pitch, the measurement of pitch diameter secured is unaffected by any error of angle which may be present in the thread measured. The angle of thread may be easily checked by taking a measurement with the next larger size of wire.

The glass bottles in which the wires are packed give protection against rust and loss or breakage of wires. The label on each bottle shows the calibrated diameter of the wire to hundred-thousandths of an inch. On the label is also given the formula for the measurement of pitch diameter of the screw thread. When using the "best size" wire to find the pitch diameter, all that is necessary is to subtract a constant given for the three wires from the micrometer measurement taken over the wires as they lay in the screw thread.

The set shown in the accompanying illustration includes the common sizes of wires from 6 to 36 pitch, and contains all of the wires needed for the measurement of U. S. Standard, S. A. E., National Coarse and National Fine threads between these pitches. Additional sizes are made ranging from a ½-in. diameter measuring plug to wires for measuring 90-pitch threads, which are 0.00641 in. in diameter.

When It Pays to Have Machines Idle

BY JOHN R. GODFREY

Man is a funny bird. And an X-ray of the stuff which passes for brains would in many cases be a good imitation of a vacuum. The particular kind of a bird I have in mind is the alleged manager who won't buy a machine unless he can keep it busy all the time.

Such a bird was giving a new grinding machine the once over not so long ago. It was a whale of a machine and the way it chewed off metal was a marvel to all beholders. That was why the aforesaid manager didn't order one. It did the work too quickly. He couldn't keep it busy all the time and an idle machine is his pet aversion. "Eats its head off" was his favorite bromide when giving his reason for not buying.

THE POINT OF VIEW

It's the old story of not looking at the whole subject—of seeing just one particular angle and forgetting the real factor, net cost. It's the same type of managerial mind which refuses to pay a good man a dollar an hour and pays two dubs sixty cents each to do the same work.

The ideal condition is to have every machine working at its maximum. But the man who tries to limit his equipment to his exact requirements, soon strikes a snag. Machines will break down and wear out occasionally. Tools will break and men still get sick or bury their mothers-in-law occasionally. And so every good manager allows a surplus machine equipment to take care of this. Otherwise he finds production schedules completely busted and delivery dates a thing of the past.

We all like to see every machine busy. But if we can save money by running a machine only one week a year, that's the thing to do. It's all a question of balancing one expense against another—and that is really the essence of successful business.

This doesn't mean that you should buy every machine that comes out, even if it can do some of your work faster than those you have now. What you want to do is to figure the first cost, interest on investment, overhead charges by the year and see how much your product costs per piece with these charges against it. Of course you count labor, but only while it is operating the machine, for labor is at work elsewhere even when the machine is covered with grease and glory.

SURPLUS MACHINE CAPACITY

It frequently happens that a machine that can clean up all the work necessary in one week out of four, is a paying investment. Even if careful calculations show that the new machine will not more than break even, and it has surplus capacity, it is usually a good buy. For this surplus capacity is an incentive to find other work for the machine, and it frequently happens that work which was not at first considered, finds its way to the machine and is done more economically than before. Surplus machine capacity is usually much better than surplus floor space. You always have the possibility of increased production without further expenditure and at a reduced overhead.

So, before you join the ranks of the one-idea managers, who think a machine that is not working all the time is a poor investment, just figure it out from all sides. The chances are you'll be money ahead at the end of the year if you buy it.

News Section

March Exports of Steel Total 210,095 Tons

Exports of iron and steel from the United States in March totaled 210,095 long tons, an increase over January and February of this year of 40 and 55 per cent respectively. These figures are taken from statistics compiled by the iron and steel division of the Department of Commerce. Noticeable increase was made in the exportation of flat steel sheets, steel rails and plates, boiler tubes and welded pipes, structural steel, iron and steel bars, plain wire, ingots and wire rods. Shipment of wire nails, tin plate, fabricated structural steel, iron and steel castings, horseshoes and ferro-manganese fell off somewhat during this month. The total volume of American exports of iron and steel for the first quarter of the year (508,070 tons) is at the rate of slightly more than 2,000,000 tons for the year. In 1921 the total, which comprised only those commodities listed according to quantity in the export transportation obtaining at that time, was 2,171,282 tons. For the year 1920 the volume of export was 4,702,632. There is evidence that the total volume for 1922 will exceed 1920.

Course in Employee Training at Wisconsin

A course in "Employee and Foremanship Training" has been established in the department of industrial education and applied arts of the University of Wisconsin, Madison, Wis. The purpose of the course is to give to students of engineering a conception of the problems of education and training found in industry, and the opportunities for trained men and women in various industrial positions. A careful study is made of the programs of large factories and corporations, and of the various foremanship courses given by other schools and agencies.

Federal Approval of Philadelphia Exposition

Full approval of Federal participation in the Philadelphia sesquicentennial celebration has been voted by the committee on industrial arts and expositions, which has reported, with certain amendments, the Darrow bill and recommends that it receive the prompt approval of the House.

The bill as amended specifies that Fairmount Park shall be the site of the exposition and that the form of Federal participation is to be determined by the President.

The committee believes that the sesquicentennial will be even more potent in its influence on industry than was the exposition in 1876 and in its official report to the House predicted that the exposition in 1926 will be the greatest international affair of the kind ever held.

Motor Car and Truck Production Increases

Reports received by the Department of Commerce show a further increase in the production of automobiles during April. New records were made for the output of both passenger cars and trucks, compared with the preceding ten months for which figures are available.

With the reports lacking for only a few small companies, the total April production of passenger cars amounted to 196,512, or an increase of nearly 30 per cent over the March production of the identical firms. The April truck production totaled 21,944 machines, compared with 19,449 from the same firms in March.

The following figures give the production for identical firms for the past four months.

1922	Passenger Cars	Trucks
January	81,638	9,204
February	109,039	12,968
March	152,647	19,449
April	196,512	21,944

Standards Committee to Conduct Survey

At the request of Secretary of Commerce Hoover, the American Engineering Standards Committee will undertake a canvass to determine what simplification in manufactured products is most needed and most desirable. This canvass will be conducted through the engineering and technical bodies having representatives on the committee, or co-operating in its work, and the survey will extend into almost every line of activity in America.

This assignment to the American Engineering Standards Committee is one of Secretary Hoover's steps to save for American industry a few of the many millions of dollars wasted annually, as has been revealed in the report on waste in industry which was made not long ago by a committee of the Federated American Engineering Societies. This request of Secretary Hoover and its acceptance by the committee is significant of the close co-operation between the Department of Commerce and American engineering and industrial bodies. There seems to be a general recognition of the fact that simplification of products and the improvement of processes are to a large degree only other words for standardization. This joint movement for standardization and simplification now under way may therefore be said to have begun its work in its own household, by standardizing, simplifying and unifying its own machinery and processes.

Representatives of this committee recently held a conference on this subject with Mr. Hoover, in Washington, and arrangements were made for an exchange of representatives between the two organizations so that there may be the closest possible co-operation between them.

Freight Loadings and Repairs

Loading of revenue freight totaled 755,749 cars during the week ending May 6, compared with 758,286 cars the previous week, or a reduction of 2,537 cars, according to reports just filed by the carriers of the United States with the car service division of the American Railway Association. This was, however, an increase of 34,027 cars over the corresponding week last year.

Compared by districts, increases in the total loading of all commodities over the preceding week were reported in only the Eastern and Central western districts, while all reported increases over the corresponding week last year except the Alleghany and Southwestern districts.

Freight cars idle on American railroads, because of business conditions, totaled 521,746 on May 8, compared with 529,658 on April 30, or a decrease of 7,912.

Of the total, 353,239 were surplus freight cars, while the remaining 168,507 were freight cars in need of repairs in excess of the normal number unfit for service.

Of the 2,274,240 freight cars on line, reports showed 327,704 or 14.4 per cent to be in need of repairs on May 1, compared with 317,783 or 13.9 per cent on April 15. Allowing 7 per cent of the cars on line as representing the normal number in need of repairs would leave 168,507 cars as the number idle because of business conditions and need of repair.

Revenue Bureau Gives Ratios for Amortization

The Internal Revenue Bureau has announced ratios of estimated post-war cost of replacement, for use by taxpayers in computing claims for tentative allowance for amortization. The ratios are expressed in percentages based on prices as of June 30, 1916, and include the following:

Electrical machinery and equipment, 130 per cent; engines, turbines, compressors and similar facilities, 175 per cent; pumps, 135 per cent; boilers, 160 per cent;

Transmission equipment including shafting, pulleys, hangars, etc., 135 per cent; belting, 100 per cent.

Machine tools and small tools (machine tools considered as that class of metal working machinery which can be used on both cast iron and steel), 130 per cent.

Wood working machinery, 155 per cent.

Textile machinery, 155 per cent.

All other machinery, including cranes, the cost of which did not exceed 10 cents per pound as of June 30, 1916, 120 per cent; machinery the cost of which did exceed 10 cents per pound as of June 30, 1916, 130 per cent.

Further information on amortization requirements appear on page 836d.

Steel Treaters Meeting in Pittsburgh

A sectional meeting of the American Society for Steel Treating, taking in the chapters of the society from Cleveland, Buffalo, Rochester, Syracuse and Pittsburgh, was held in the auditorium of the Bureau of Mines in Pittsburgh May 25, 26 and 27. The out-of-town chapters were the guests of the Pittsburgh section and were welcomed at the opening session by N. D. Hoffman, chairman of the Pittsburgh Chapter.

At the first session the following papers were presented: "Fiber in Steel and Iron," by Prof. F. F. McIntosh of the Carnegie Institute of Technology; "Mass Influence on Heat Treating," by W. B. Crowe, metallurgist, Carnegie Steel Co.; and "Impact Tests," by J. N. Lessels, Westinghouse Electric and Manufacturing Co. At the close of this session the members adjourned to the University Club where they were the guests at an informal dinner.

The morning of the second day was spent in visiting steel mills and manufacturing plants in and around Pittsburgh, ending with a luncheon at the Westinghouse plant. In the afternoon under the chairmanship of H. M. Boylston, of the Case School, papers were presented on: "Abrasive Qualities of Carbon and Alloy Steel," by A. M. Cox of the Pittsburgh Commercial Heat Treating Company; "The Importance of Properly Heating and Cooling Steel," by J. A. Succop of the Heppenstall Forge and Knife Co.; "Manufacture of Springs," by D. A. Smith, Union Spring and Manufacturing Co.; "Change in Dimensions of High Speed Steels in Heat-Treatment," by M. A. Grossman. Electric Alloy Steel Company.

In the evening the members attended a smoker at which a motion picture showing the operation of an open hearth furnace was exhibited through the courtesy of the American Rolling Mills Co. This completed the technical phase of the convention, the last day being devoted to a meeting of directors and executives. The convention was closed with an entertainment on Saturday evening at Carnegie Institute.

Gary Counsels Optimism and Confidence in Future

Prefacing his remarks at the opening of the twenty-first annual meeting of the American Iron and Steel Institute, held in New York City on May 26, with a frank statement of confidence and optimism in the future of American business, Elbert H. Gary, chairman of the board of the United States Steel Corporation, delivered an interesting analysis of conditions in the United States, taking up legislative and industrial problems which directly affect the present. The meeting was well attended by prominent steel producers and manufacturers.

In a clear definite manner Judge Gary presented a message of common sense philosophy. It was a message filled with encouragement, and the earnestness with which he spoke greatly impressed his audience. What he said on the great subjects now foremost in the minds of the public, deserves the sober thought of every fair-minded citizen. The tariff revision he likened to an "intermittent disease," appearing at least with every change in administration if not with every session of Congress. He deplored the fact that the work done and the data collected by the National Tariff Commission at great expenditure of public money, had been entirely ignored. Today the tariff has become largely a local issue, favoring certain classes and not adjusted to suit the welfare of the body politic. That there is urgent need for a permanent tariff commission consisting of well paid and non-partisan men to adjust rates on a scientific basis seemed to him to be quite evident.

On the much discussed subject of the soldier bonus he counseled that final judgment be deferred. Because of the already heavy burden of taxation the country is not reaping the full limit of its opportunities; far better at this time it seemed to him to employ the funds required by a bonus bill in making the necessary extensions to industry so urgently required; that in thus furnishing employment the need for a bonus would be shown to be in a great measure unnecessary. If and when a bonus is paid the fairest method least likely to burden the people at large seemed to him to be by taxation, equally distributed. He said that he believed the sales tax represented the fairest method of all.

On the subject of Government in business he said that governmental regulation and investigation of industry was to be welcomed, provided it was conducted along non-partisan lines. He thought there was a disposition lately to exempt labor and farmer organizations from any such supervision. This exemption gave to such organizations power to do things beneficial to themselves but injurious to others—in short to create class distinction. He declared that governmental regulation could never be successful unless applied fairly and equally to all.

As to future business conditions Judge Gary held out great hopes. Though obscured at times since the signing of the Armistice, profitable business and general prosperity for all industries and for the people of this country are today nearer realization than at any time before.

At the banquet in the evening, held in the Hotel Commodore, Judge Gary presided. Earl French was the guest of honor.

Machinery Company Denied Another Hearing

On the ground that the case was heard twice before the Supreme Court and all phases of the controversy considered, Solicitor General Beck, for the Government, has opposed the motion of the United Shoe Machinery Co., for rehearing and modification of the court's decree in the case which banned leases of shoe machinery under the anti-trust law. He opposes authority being given the District Court to permit use of clauses in the leases which under other circumstances might not be violative of the law, on the basis that it would open up the case to endless litigation and defeat the effectiveness of the decree.

Veterans' Bureau Can Supply Trained Workmen

The United States Veterans' Bureau has 130,738 ex-service men in training status who are receiving instruction in every trade of industry and in agriculture. They are completing their courses at the rate of 500 a month. Manufacturers who want personnel trained in a particular vocation, are asked to write to the Rehabilitation Division, Employment Section, U. S. Veterans' Bureau, Washington, D. C.

The Government is conducting the largest trade and industrial school in the world in which more than 130,738 students are enrolled. The instruction in these vocations is furnished in leading colleges, technical and commercial schools, as well as in business establishments, shops and on farms. The men are in training in every state in the union and in every large city in the country. In all the large industrial centers the men who have received this intensive training from the Government are available for positions. Every vocation is represented and any employer who needs additional personnel will be furnished such personnel from his vicinity in short time by notifying the bureau.

These men are not permitted to terminate their training until the bureau is assured that they are skilled workmen and capable of carrying on in the vocation for which they are trained, and meet the requirements of the commercial, industrial and agricultural world.

The public has the impression that the majority of men who are receiving vocational training suffer from amputations. This impression is erroneous as statistics compiled by the bureau show that less than two per cent of the men in training suffer from amputations.

Employers who wish to employ these ex-service men who have been trained and whose ability to successfully carry on in a vocation has been assured by the training given, should correspond with the above address, state the type of personnel required, when the position is available and the place of employment.

General Conditions in Italy Show Better Business

Unemployment in Italy which reached the high point of 606,819 on Feb. 1, has registered 576,284 on March 1, and 498,606 on April 1, says a cable to the Department of Commerce from Mr. MacLean, commercial attaché at Rome. Business failures still reflect unsettled conditions in Italy, and during April totaled 277, as compared with 306 during the previous month, and 110 during April of last year.

The Bachi index of wholesale prices, based on the average price in 1920 of seventy-six commodities, registered 84.37 for April as compared with 85.43 for March, and 90.1 for February.

December exports were approximately 865,000,000 lires, an increase of 147,000,000 lires over those of the previous month.

Government expenditure during the five month's period of last year, July to November, amounted to 6,291,000,000. This represents a decrease of approximately 2,238,000,000 from those of the same period in 1920.

Germany's Labor Problem

Wage Regulations Retard Production—High Rents and Living Costs a Burden—Management Hampered by Union Rules—Exchange the Barometer of Business

By OUR BERLIN CORRESPONDENT

(Continued from last week's issue.)

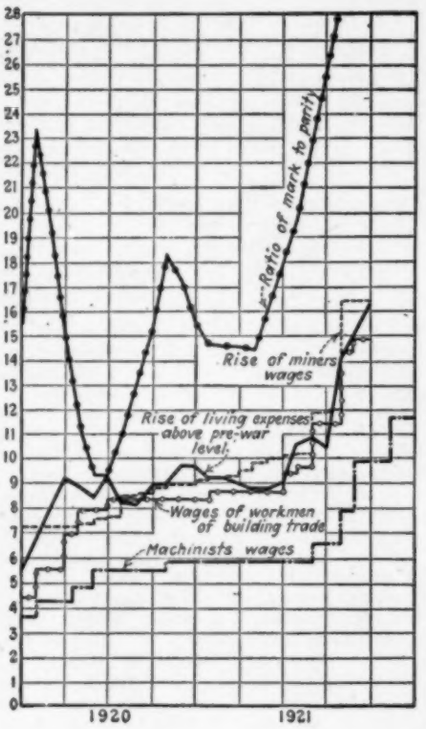
It is part of the labor regulations that wages are settled by agreement between employers' associations and employees' unions. Such agreements, called "wage tariffs," are concluded in large towns locally, in small towns and in the country for districts. They are contracted for a specific time, sometimes a year, but can be terminated by notice of a month or so, according to special arrangements. They include also stipulations for additional payments like subsidies to wife and children, provisions for holidays, and stipulations for piecework payment, especially the minimum earnings granted to pieceworkers.

The network of regulations, cleverly woven round the wage problem, naturally acts as a retarding force. Spread over the whole field of production and exercised with special care and exactness where necessities of life are concerned (in which respect it is further helped by the criminal law dealing with excess profits), it has enabled the administration to keep prices down, even after the control of prices on food stuffs and other commodities has been removed. It is, however, very doubtful whether this expedient will work permanently. Recent developments, resulting in an upward rush of all prices, are rather alarming in this respect. They are, of course, caused by the unprecedented depreciation of the currency, but the disquieting side of it consists in the fact that prices by their great inertia will not stop simultaneously with the exchange fluctuations.

The Rent Factor

Deliberate actions of the government to keep prices down have in the course of time diminished to the care taken of grain prices exercised by contributions from public funds. This last remnant of the control of food stuffs has recently been abandoned, and the insignificant reaction on the living cost is proof of the fact that this measure has in its import been greatly overrated. There is, however, another factor which is of far greater importance, and deserves special attention, not only because it is frequently overlooked by observers from outside, but also because it will supply the administration with an effective control of living costs long after all other means will have ceased to work. This is the rent factor which absorbed in pre-war times from one-third to one-fourth of the average workman's income. This part of his expenditure has, however, only doubled. If the prices of all commodities would reach the equivalent of the pre-war standards, and the workman had to be paid accordingly, he could not claim increase of the part of his income going towards housing expenses, except for the insignificant doubling of his rent which, apart from all other factors, would allow his income to be kept down below pre-war level by from 25 to 30 per cent. This is important in view of the much feared approach of prices to the gold standard. It appears, therefore, that the property owners are carrying to a large degree the burden of the administration's labor policy.

The following diagram shows five interesting curves, which held together are a very lucid illustration, not only of the labor problem but of Germany's whole industrial situation.



The first curve shows the movement of the exchange, the second that of the living cost. Of the three stepped curves, the first indicates the movement of the wages of the miners, the second that of the building laborers, and the third those of the machinists. The diagram extends over the years 1920 and 1921. The abscissa in the diagram demonstrate the ratio of the respective figures to the pre-war level. The curve of depreciation (ratio to parity) only reaches as far as September, 1921.

Regarding living cost, it should be mentioned that the exactness of the statistic index figures upon which the diagram is based is strongly questioned, not only by the workingman but also by a number of economists. It is contended that if the index figures were composed in a way conforming with pre-war living standards, and not with apparently much lower ones, they would show a much stronger deflection. Comparing living costs with money depreciation, it is seen that the first are in some measure following the latter, leaving a wide margin between. It is interesting to note that the recovery of the currency in 1921, extending from January almost to July, is hardly reflected in the living expenses, although the reversion was sharp. Though the curve of living costs show a number of fluctuations, its upward tendency as a whole is unmistakable.

In none of the three groups of workmen seen in the diagram, nor in any other, have wages ever been reduced, not even when the currency recovered from nearly 100 to 39m. to the dollar. On the contrary, the unbroken upward movement of wages in the time corresponding with that recovery was rather marked. This fact will explain the prevalent fear that in the case of a future reverse of the exchange movement, with conflicting conditions so much more pronounced than in 1920, the curves representing money and cost of labor might one day intersect, which point would no doubt mark a most severe crisis.

Divergence of Rates

It is peculiar to note how far the wages of the three groups represented in the diagram differ. The wages of miners and for building labor keep close together; the wages of the machinists' unions, which comprise all workers in the metal industry, are remaining however far below. The wages of the miners follow closely the movement of living costs, and have in places even gone beyond them. This is due to the fact that the miners occupy a rather privileged position among the workmen. With regard to building laborers, the explanation is not so easy. The reason is that building laborers have during the war and the years immediately following, in a large number joined other vocations, and cannot be persuaded to return to their old trade, unless special inducement is offered. In spite of the small amount of building work going on, workmen are scarce, a condition which gave the unions a clue to put forward claims for higher wages than are paid to other groups of workmen.

Much has been written and said about the unhealthiness and hot house nature of German prosperity, and although the arguments derived therefrom have been frequently used for the country's cause in the reparations problem and are probably flavored, they are by no means without foundation. The manufacturers are pointing out incessantly that, granted equal conditions with foreign rivals, German industry could not compete with them. Any one going through German factories—even at the present time, when intensity of production is at its highest, calling forth all reserves of energy—can bear witness that this complaint is correct in a large measure. It must be remembered that the way traversed since the revolution is marked by a forced retreat on the part of the employers, strewn with concessions to the workmen, cutting deep into the scope of management of the works.

The eight-hour day is declared by the

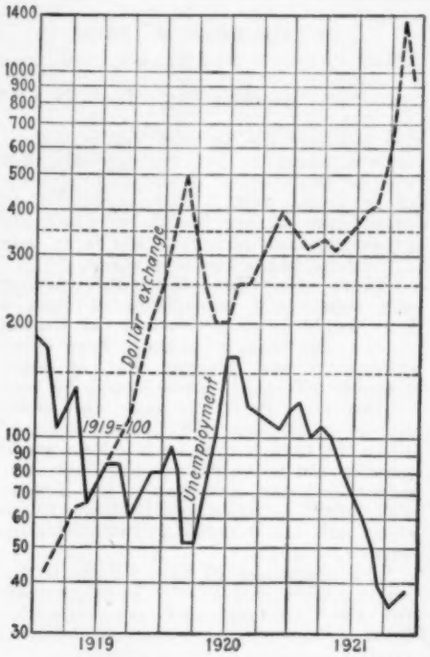
employers to be the greatest evil inflicted upon them. The shop council law, with the strong protection it gives the workman against dismissal, the prohibition of overtime, and the large financial burden the employer has to bear for providing towards workmen's welfare institutions, are further adding to the discontent. The workmen on their side are dissatisfied by the extent of concessions they have derived since their ascendancy to power. If disorganization and dissolution have not set in, and gradual recovery even taken place, it is not the fault of the new state of affairs, but solely due to the innate discipline and industriousness of the race. Quite apart from other conditions, the impossibility to dismiss workmen for incompetence suffices to frustrate all efforts to develop efficiency and exercise economy. Nothing has been done yet to make the best of the new order of things. Hardly anywhere have attempts been made to speed up the working process in compensation of the reduced working time. Manufacturers declare that such speeding up is impossible in view of the frame of mind of the workmen.

In this contention they are believed. They are solely dependent on the good will of the workmen. If the latter feel like spending an hour over work which could be done in half the time, the manufacturer cannot interfere. If there is not sufficient work, time is "stretched," otherwise it is also stretched because there is no spur for filling it adequately with work. Existing regulations prevent anything which would reward diligence and punish laziness. The spirit of equalizing, the basic socialistic doctrine, is ruling the whole situation. Differentiation is most effectively eliminated. The working speed and the economy which manufacturers can effect are those that the workmen accord them voluntarily from their sense of duty and honor. That the results are not exactly poor speaks highly for both. But even as it is, economy and efficiency in production have sunk considerably below the pre-war standard. The individual efficiency of the workman may in the average have reached 60 per cent of the old standard, but in the case of economy this percentage is much less.

Spirit Lacking

This is not entirely due to remissness on the side of the laborers, but in a large measure to an entirely disproportionate increase of overhead, depreciation of machinery, inferior quality of tools, and last but not least to the whole system lacking spirit and "pep." Moreover, it can be noticed that workmen, as well as manufacturers, have frequently lost all sense of economy, doubtless due to the continuous depreciation of money and because the elasticity of its value has so far saved manufacturers from feeling the pinch. They seem to have forgotten the old methods of making both ends meet, and are relying upon the vicious circle, which is in the habit of closing up automatically between increased cost by a rise of sale prices contingent with a further depreciation of the currency.

Probably the most dangerous item of the unhealthy conditions prevailing consists of the fact that business is not ruled as it used to be by the laws of supply and demand, but by the money exchange. A little diagram recently prepared by the State Bureau of Statistics shows two curves. One depicts the extent of unemployment; the other the exchange of the dollar in Berlin. The chart demonstrates this clearly.



In explaining the way this diagram is drawn up, it should be mentioned that the graduation of the abscissa is not equi-distant but in the logarithmic order, which it is alleged more clearly demonstrates the run of a curve. If, for instance, the mark would drop from 30 to 15 cents, this would in an ordinary diagram be expressed by a large drop. If, however, it sunk from 1 to ½ cent, the deflection in the diagram would hardly be visible, although it would mean a drop from 100 to 200m. to the Dollar. In the diagram the curves representing unemployment and the movement of the dollar exchange in Berlin are running exactly counterwise. The dependency of business on the fluctuations of the exchange is even increasing as the movement of prices is more and more drawn into the vortex. Up to now, it has been possible to preserve a certain continuity of prices, but during the last months a growing tendency has become noticeable of prices quickly following the inflections of the currency. This is no doubt due to the fact that the prices of a number of commodities of everyday use have already reached pre-war parity, and for this reason are bound to follow the lead of the money market, thereby influencing the rise and fall of the whole market to a certain degree. The money exchange has become the business man's barometer. Like the seaman's first glance in the morning is up to the sky, the German business man's first look is at the dollar exchange. This state of things would probably not be so dangerous if the money market were controlled with a view to maintaining a certain steadiness, or if at least it were left to itself. But this is not the case. The relation of the mark to the dollar is by no means ruled solely by the state of the finances, but rather strongly by hopes and disappointments, based upon happenings of the most divergent nature, political and economic. This picture of Germany's economic life is unique and full of unhealthy perversity. Jokers say that when Lloyd George smiles in Genoa, eggs get cheaper in Berlin. This is not a mere jest but contains more than a grain of truth. It is certainly true that a number of mark speculators, bulling or bearing it at will, are able to shake the whole structure of business life to the very foundations. All the institutions devised to protect the business man against the effects of currency fluctuations and contracts concluded in foreign standard currency, are of no avail in such emergencies. The trend of business bears no more semblance to a uniform current but rather to a whirlpool full of eddies and undercurrents, making navigation extremely difficult and dangerous. In view of this picture, the prosperity seen everywhere looks puffed up and unhealthy.

A Great Wage Problem

Although the advantages of a stabilized currency are obvious and realized everywhere, the feeling among business men in this direction is divided. There is no doubt that in the case of a stabilized exchange, no matter in what relation to parity stabilization is effected, prices and wages would adjust themselves to the standard of currency, and gradually run up close to it, thus diminishing the economic advantages producers now enjoy. Stabilization of the currency would squash all hope of a future improvement of the exchange. This hope plays an important part in the present scheme of things. If wages and prices are soaring up, a timely arranged bulling of the mark has never failed to check this movement. A good many of the arguments used to keep wages down rest upon the unsettledness of the exchange. The most effective argument, for instance, against the strongly advocated scheme of putting wages on a sliding scale is supplied by the possibility of a recovery of the exchange, in which event the wages would be forced down. If this is accompanied by a "propaganda of hope" through the public mouthpieces, and with fluctuations of the exchange clearly demonstrating that the mark might go up as well as down, a state of uncertainty is produced which so effectively dims the vision of everyone that the treatment of the labor problem can follow the crooked course into which economic conditions force it, without it becoming clearly visible to the observer.

Moline Plow Reorganized

The Moline Plow Co., Moline, Ill., has been reorganized and has taken in the Stephens Motor Car Co. as a subsidiary. The new company is being launched with $16,000,000 of current assets and with all current indebtedness cleared from its books, except a few accrued current expenses. The officers of the reorganized company are: President, George N. Peek; vice-presidents, H. S. Johnson, R. W. Lee, F. W. Edling, C. B. Rose and H. B. Dinneen; secretary, L. C. Shonts; treasurers, F. N. Honenigman and John Hammerich. Frank O. Wetmore, president of the First National Bank of Chicago, is chairman of the board.

The Business Barometer

This Week's Outlook in Commerce, Finance, Agriculture and Industry Based on Current Developments

BY THEODORE H. PRICE
Editor, *Commerce and Finance*, New York

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A 10 per cent reduction in our railway freight rates and a meeting of the world's greatest bankers in Paris to consider lending between one and four billion dollars to Germany were the outstanding events of last week in the business world.

Their significance is not yet appreciated or rightly understood. In the stock market the reduction in freight rates was unfavorably construed and this construction was reflected by a slight decline in railway shares. It will be short lived, for the lower rates will greatly augment the traffic and bring an increase in gross earnings that will benefit both the country and the carriers.

When about two years before his death I was talking of railway rates to the late E. H. Harriman he said: "Price, give me the gross and I will take care of the net. The earnings of a railway depend upon the density of its traffic. If I can get all the freight I can haul that is all I want."

In these epigrams Mr. Harriman briefed the policy that made his roads successful. The larger the traffic the cheaper he was able to carry it, and I venture the prediction that the increase in gross revenue which will follow the rate reduction ordered last week will be so surprising that the railways will themselves take the initiative in applying for a further reduction. Cheaper transportation and greater profits I believe would be the effect if Secretary Mellon's proposal for removal of government restrictions on rate making for five years were adopted, though there is little likelihood that it will win public support. But as the reduced rates do not take effect until July 1, reduced earnings are to be expected during June because those who can will delay shipments until the new rates apply.

A Revival in July

I have previously named the first of July as the date upon which a country-wide revival of business would be due and the fact that it is upon that day that the lower freight rates take effect increases my confidence in the coincident arrival of a business boom.

Trahsportation is the very life blood of economic civilization and anything that tends to cheapen the cost of carrying goods from the producer to the consumer must make for prosperity. It is to be hoped that the Interstate Commerce Commission will soon order a reduction in passenger rates. As Commissioner Cox pointed out the passenger traffic is now 7,000,000,000 revenue passenger-miles below normal and from this statement some idea can be had of the increase in travel which would follow a return to prewar rates.

As to the German loan that is under consideration at the bankers' conference in Paris, it can probably be taken for granted that a bond issue will be arranged on some terms. The amount, the rate and the security are of course undetermined as yet, but a loan that will be sufficiently large to take care of her reparation payments until Germany gets on her feet is so obviously necessary and desirable that it is safe to assume that it will be made.

There are some who doubt whether any substantial proportion of such a loan would be subscribed in the United States, but leading bankers here think differently and believe that at least $500,000,000 gold bonds could be sold in this country if the rate were sufficiently attractive. This belief is based upon the theory that such a loan would greatly aid in liquifying the debts due our merchants and banks by Europe and South America and that our financiers will leave nothing undone to insure its success.

The soundness of this theory is unquestionable and as the arrangements for the loan approach consummation further buoyancy in the stock and commodity markets is to be expected.

Markets Are Sound

The confident tone that has recently prevailed in these markets showed no abatement last week. Copper is now up to 14 cents. Sugar is firmer and as the surplus supply disappears higher prices seem indubitably indicated. Rubber is steady and the activity in the tire business is commencing to make an impression upon the American stocks of rubber. Cotton has been steady. Everyone is bullish on cotton and the position is statistically strong, but it should not be forgotten that the crop generally improves during June.

The iron and steel industry is almost booming, but the much-talked-of mergers are held up pending the approval of the Attorney-General. As a speculative influence their effect is probably spent. Wool and silk are again higher and the dry goods market shows more activity from day to day.

The New England textile strike is gradually wearing itself out. It has so wearied the New England manufacturers that many of them are talking about moving South, but it is unlikely that any of them will actually move, though it is to be doubted whether many more cotton mills will be built in the North.

Money is still easy, though the increased borrowing of New York stock brokers is gradually absorbing the surplus funds of the New York banks.

Thomas A. Edison's proposal that the Government should build warehouses for the storage of farm products against which Federal Reserve Notes should be issued for half the average value during the previous 25 years, has attracted not a little attention and is said to have been favorably received by some of the farm "bloc" in Congress. It appeals to the agrarian imagination, but no attempt to give it effect seems likely.

The sale of 40,994 shares of the stock of the National Bank of Commerce in New York at $267 per share for account of the Mutual Life Insurance Co. and the Equitable Life Insurance Co. of this city is something of novelty. The stock was sold within two hours and the success of the offering may indicate that the investment demand is shifting from bonds to stocks. Fewer new securities are being floated and more stock issues are appearing among them. The demand for funds for current business uses is increasing and as industrial improvement continues the money market will surely tighten. Country banks are said to have been active buyers in the bond markets, employing funds which business probably will want within a few months, and steady expansion of Federal Reserve rediscounts is to be looked for. Perhaps it is already under way, for the report of the system for the week ended May 24 shows that bills on hand totaled $592,604,000, an increase of nearly $30,000,000 over the previous week. It was offset, however, by the acquisition of $2,500,000 additional gold, and the reserve ratio shows only a one point decline to 77.5 per cent.

The apathy with which the coal strike is regarded is not favorable for its early settlement. The union leaders seem to have picked the time for the strike with more shrewdness than was generally considered, for it is reported that in some fields reviving industry is making it easy for the strikers to find sufficient work to keep them alive and they are holding out better than seemed possible. On the other hand industry professes to be well supplied for at least two months yet, and the strike is not likely to create a critical condition until July. Of almost as great importance is the setback which the building boom is experiencing in New York and Chicago through labor troubles, including bombings, strikes, and the intolerable jurisdictional disputes of the unions.

These are the black spots of the picture. They are almost invisible in the sunshine which floods the view. Though we realize that there are clouds which, arising in Washington or Europe, may appear over the horizon, for the present it seems perfectly safe to venture out without an umbrella.

Machinists in U. S. Best Paid in World

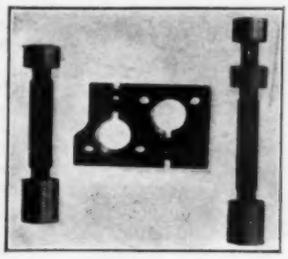
In a Senate tariff debate last week, Senator Gooding of Idaho gave the average daily wage of machinists in various countries. In the United States he stated they were $6.40; in England $2.90; in France $1.38; in Japan $1.50; in Italy 82 cents and in Germany 72 cents. The Senator gave these figures as an argument for protecting the American workmen against the products of cheaper labor.

Condensed-Clipping Index of Equipment

Patented Aug. 20, 1918

Gages, Spark Plug, Limit, "Trilock"
Pratt & Whitney Co., Hartford, Conn.
"American Machinist," February 2, 1922

The gage set is made to S.A.E standard limits and consists of a double-end limit plug gage, a "go" and "no-go" templet in one unit, and a setting plug for the templet with a cylindrical plug for checking the root diameter. The pitch diameters of the plugs are 0.841 and 0.843 in. and the tolerance for tapped holes is 0.002 in. The templet pitch diameters are 0.836 and 0.839 in., giving 0.003 in. tolerance for the threads on the body of the spark-plug. There is a neutral zone of 0.002 in. between the maximum spark-plug and minimum hole sizes.

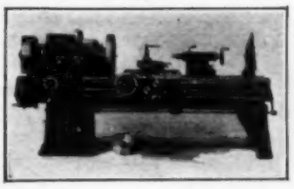


Grinding Machine, Motor Drive for
Grand Rapids Grinding Machine Co., Grand Rapids, Mich.
"American Machinist," February 2, 1922

This arrangement for motor drive is applied to the No. 1 universal grinding machine. The stand consists of a cast-iron base, into which is screwed an upright section of heavy iron pipe, carrying at its top a table casting to which are bolted the motor and countershaft. The grinding machine is bolted to the base casting. The starting switch is located on the column, directly back of the machine. Any make of motor may be used and a reasonable variation in motor speeds is allowable.

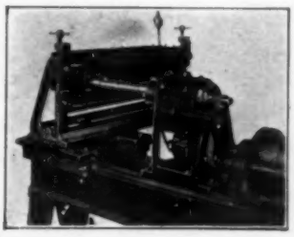
Lathe, Engine, Coneless, Geared-Head, 18-in.
Boye & Emmes Machine Tool Co., Cincinnati, Ohio.
"American Machinist," February 9, 1922

The headstock, reversing gear and arrangement for mounting the driving motor are different from the standard lathe design. Twelve spindle speeds are obtained by shifting the jaw clutches. The spindle is controlled by a vertical lever on the apron and an auxiliary lever below the headstock. The range of spindle speeds is from 9 to 350 r.p.m. Longitudinal and cross feeds cannot be engaged while screw-cutting. Forty threads, from 2 to 56 per in. can be cut without changing gears. Feeds, $\frac{1}{8}$ to 224 per in. Floor space, 10 x 3 ft. Weight, 4,270 lb.



Grinding Attachment, Cylinder, Lathe, "Elteco"
Liberty Tool Co., 1080 Springfield Ave., Irvington, N. J.
"American Machinist," February 9, 1922

The machine is attachable to an engine lathe having a swing of 14 in. or more. The work holder is mounted on the lathe carriage, the spindle head on the ways; and the headstock of the machine drives the rotary feed of the wheel spindle. Spindle drive is by means of a $\frac{1}{4}$-hp. electric motor. An eccentricity up to 1 in. in diameter can be obtained, the amount being varied by a screw graduated to 0.0005 in. Cylinder bores from 2$\frac{1}{2}$ to 7 in. in diameter can be ground. Longitudinal work feed is obtained by using the lathe carriage feeds. Spindle speed, 5,600 r.p.m. Weight, 500 lb.



Saw, Cut-Off, Swing, Motor-on-Arbor, No. 36
Oliver Machinery Co., Grand Rapids, Mich.
"American Machinist," February 2, 1922

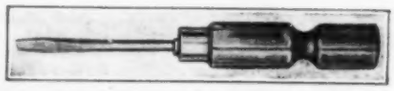
The machine is made with three frame lengths, 5 ft. 5 in., 7 ft. 5 in., and 9 ft. 5 in. The motor operates on three-phase, 60-cycle, 220 or 440 volt alternating current, has 3 hp., and runs at a speed of 3,600 r.p.m. The saw carried is ordinarily 16 in. in diameter and is protected by a guard. The motor is controlled by a push button above. The device can be furnished with the motor mounted on top of the swinging bracket and belted to the saw arbor, or larger size saws can be driven from a countershaft.

Grinder and Buffer, Flexible-Shaft
Valley Electric Co., St. Louis, Mo.
"American Machinist," February 2, 1922

The ball-bearing motor used to drive the wheel is mounted in trunnions in a fork that is carried on ball bearings for swiveling the motor in any direction. The flexible shaft permits the wheel to be moved to any position. Different types of abrasive wheels may be employed. The device is made in both $\frac{1}{4}$ and $\frac{1}{3}$ hp. sizes to operate on either 110- or 220-volt alternating current of 60 cycles and one- or three-phase, or on direct-current of the same voltage. Bench space, 14 in. square. Weight, 80 to 100 pounds.

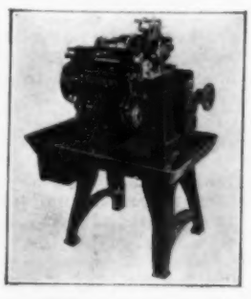
Screwdriver, Ratchet, Hand
H. D. Chapman, 2929 Clifton Ave., Baltimore, Md.
"American Machinist," February 9, 1922

The device is made in three sizes. With it a strong torque can be obtained on the screw at the same time that the axial pressure is applied. The top of the handle is rigidly fastened to the shank or blade. The lower part of the handle at the center of the tool is free to rotate about the shank. By means of a ratchet device, this lower handle may be engaged with the blade so that it is free to turn in one direction only. This direction may be reversed.



Forming Machine, Cutting-Off, Duplex
L. P. Brown Machine and Tool Co., Attleboro, Mass.
"American Machinist," February 9, 1922

The machine forms and cuts off parts not requiring turret tools, but ordinarily machined on an automatic screw machine. It has two spindles. A two-speed countershaft provides 6 feed changes from 240 to 1,820 r.p.m. The feed, independent of the forming movements, may be set to any length up to 3 in. Forming tools independently adjustable and carried on a single cross slide, operate simultaneously. Cut-off tools are carried on slides at an angle of 30 deg. to the vertical to allow clearance between the forming and cut-off tools. Floor space, 44 x 26 in.



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William Gleason, of Rochester, Dead

William Gleason, pioneer manufacturer of machine tools, and president of the Gleason Works, of Rochester, N. Y., died at his home in that city on May 24. He was 86 years old.

Mr. Gleason came to this country from Ireland in 1851 and learned the machinist trade in the shop of Asa

WILLIAM GLEASON

Smith in Rochester. During the Civil War he worked in Colt's Armory in Hartford, Conn.

In 1865 he returned to Rochester and organized the nucleus of the present machine works. In 1873 he perfected what is said to be the first practical bevel gear planer. Since then he has turned out several important improvements in the design of gear planers.

Of late years he has been inactive in the management of the Gleason shops, leaving that to his son James E. Gleason. A daughter, Kate Gleason, is a vice-president of the company, and is one of the few mechanical engineers of her sex in the country. She is well known for her designs of gear machines.

American Foundrymen in Rochester Next Week

Plans have practically been completed for the annual convention and exhibit of the American Foundrymen's Association to be held in Rochester, N. Y., June 5 to 9. A comprehensive program of technical papers covering every phase of the foundry and allied industries has been prepared by the committee on arrangements. The speakers include some of the most important men in the industry. Nine sessions will be devoted to reading of technical papers and committee reports. There will be an international session at which papers by American, British, French and Belgian foundrymen will be read and discussed. Other sessions will include steel, brass, aluminum, gray iron, industrial relations, molding sand research, malleable cast iron and a general business session. As has been the custom in the past, a joint non-ferrous session will be held with the Institute of Metals Division of the American Institute of Mining and Metallurgical Engineers.

The exhibit is expected to be one of the largest ever held.

Amortization Requirements

Regulations 62, relating to Income Tax and War Profits and Excess Profits Tax, under Revenue Act of 1921, provide, in respect to amortization of war facilities, Article 184 (2), that in the case of property subject to amortization, the value in use shall be "not greater than the estimated cost of replacement under normal post-war conditions, less depreciation."

Prior to the promulgation of Regulations 62, it was not possible to amortize war facilities, which were in full use in a going business. The new regulations, however, provide, as indicated above, for amortization of what is commonly referred to as excess cost. Roughly speaking, the amortization which might be allowed on such a facility would be the difference between the original cost and the estimated normal replacement value. The accumulation of data necessary to establish such normal replacement cost is necessarily a considerable task. Engineers of the amortization section have already called upon a majority of the machine tool manufacturers and have secured such data as was requested. There are, however, a number of manufacturers who have not yet been asked for this information. The writer has been informed that it is the intention of the Bureau of Internal Revenue to write to such manufacturers requesting this information. This data is to be used, as indicated above, to determine the difference between the cost of machine tools during the war and the cost of the same articles under post-war conditions. This information is necessary in order to enable the department to determine proper allowances for amortization and all prices are held strictly confidential.

Where such information is not on file in the Department, there is either a delay while it is being secured, or if the manufacturer is unwilling or dilatory in supplying it, the claim is necessarily settled without it—possibly to the detriment of the taxpayer.

It is evident, therefore, that the work of the amortization section will be greatly expedited if all requested data, as indicated above, is furnished by the manufacturer. The settlement of income tax claims tends to stabilize conditions in the machine tool industry, and also among the machine tool builder's customers. This is an indirect result that follows.

As the latest current price on any article is also a factor in determining normal post-war replacement costs, it is essential that the latest prices be on file in the department at all times. It is recommended that machine tool builders furnish this information to the chief of amortization section as soon as any new lists are issued. This information will, of course, be held strictly confidential.

Henry H. Morse, Chief of Commerce Division

Secretary of Commerce Hoover has announced the appointment of Henry H. Morse, of Boston, to be chief of the specialties division of the Bureau of Foreign and Domestic Commerce. The appointment becomes effective July 1. Mr. Morse brings to the bureau the wide experience in the export trade, an intimate acquaintance with foreign markets and a wide practical knowledge in the field of specialties. He is well known in New England business circles, having served as chairman of the Boston Export Round Table since 1919, and as chairman of the committee on Trade Expansion of the National Boot and Shoe Manufacturing Association. He was honorary vice-chairman of the National Foreign Trade Convention in Cleveland, in 1921, and is at present the director of the New England Chamber of Commerce, and chairman of the Advisory Committee on Foreign Mails.

DOMESTIC EXPORTS OF METAL WORKING MACHINERY FROM THE UNITED STATES, FOR THE MONTH OF MARCH, 1922

Countries	Lathes		Boring and Drilling Machines		Planers, Shapers and Slotters		Milling Machines		Sharpening and Grinding Machines	
	Number	Dollars	Number	Dollars	Number	Dollars	Number	Dollars	Number	Dollars
Belgium	1	1,099	...	.....	1	41	..	.....	3	350
Denmark	1	1,435	...	.....	..	.....	..	.....	...	.....
France	3	2,266	...	.....	4	4,014	5	5,441	8	3,087
Greece	...	.....	...	.....	..	.....	1	100	30	113
Latvia	4	1,809	1	60	..	.....	..	.....	...	.....
Netherlands	...	.....	4	85	..	.....	..	.....	32	139
Norway	...	.....	2	145	..	.....	..	.....	1	936
Spain	2	2,611	3	575	..	.....	..	.....	41	2,087
Sweden	...	.....	2	985	1	1,165	..	.....	...	.....
England	3	438	1	1,348	..	.....	2	392	36	16,188
Scotland	...	.....	...	.....	..	.....	1	140	...	.....
Canada-Maritime Province	...	.....	1	174	..	.....	..	.....	45	188
Quebec and Ontario	21	10,193	30	1,653	3	199	7	2,459	171	17,797
Prairie Province	3	800	1	9	..	.....	..	.....	38	658
British Col. and Yukon	2	3,028	...	.....	..	.....	..	.....	14	296
Mexico	18	15,846	20	7,657	1	1,148	9	1,117	9	520
Cuba	3	1,269	...	.....	..	.....	..	.....	2	169
Argentina	6	119	...	.....	..	.....	..	.....	...	.....
Brazil	3	31,881	1	12,182	..	.....	..	.....	57	827
Chile	1	718	...	.....	..	.....	..	.....	1	669
Colombia	5	8,881	...	.....	..	.....	..	.....	...	.....
Peru	...	.....	...	.....	1	2,328	..	.....	...	.....
Venezuela	2	1,019	...	.....	..	.....	..	.....	15	71
British India	...	.....	93	1,292	..	.....	3	2,560	2	1,435
China	6	5,295	3	416	1	350	..	.....	2	135
Other Dutch East Indies	...	.....	1	52	..	.....	..	.....	...	.....
Japan	11	14,866	4	24,284	7	10,640	4	4,479	31	4,709
Palestine and Syria	2	1,012	...	.....	..	.....	..	.....	...	.....
Philippine Islands	1	300	...	.....	..	.....	..	.....	7	765
Australia	1	347	1	180	..	.....	9	9,129	27	196
British South Africa	13	660	...	.....	..	.....	..	.....	7	41
British East Africa	1	659	...	.....	..	.....	..	.....	...	.....
Total	113	106,551	168	51,097	19	19,885	41	25,817	579	51,378

Condensed-Clipping Index of Equipment

Patented Aug. 20, 1918

Attachment, Lathe, Bevel-Gear Turning
Warner & Swasey Co., Cleveland, Ohio.
"American Machinist," February 9, 1922

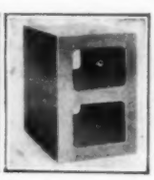
The attachment is used on No. 3-A universal, hollow-hexagon turret lathe when machining bevel-gear blanks. It is interchangeable with the top slide of the lathe carriage, and cuts all standard angles on blanks up to 14 in. in diameter. Two tool slides are operated by the hexagon turret and saddle. A shaft mounted on the turret engages a double pinion in the saddle, and transmits motion to the tool slides. The front slide operates on one side of the gear and the rear slide on the other, both moving at the same time.

Drilling Machine, Sensitive, Electric, Motor-Driven, 12-in.
Louisville Electric Mfg. Co., Louisville, Ky.
"American Machinist," February 9, 1922

The speed of the spindle can be easily adjusted. The table is counter-balanced by a weight in the column. A ½-hp. motor running at 1,725 r.p.m. is used. The motor and controlling switch are built in the machine, the motor being furnished to suit the available circuit. The machine is made in both bench and floor types, and is furnished with a V-block, cup and point centers. Capacity, up to ½-in. hole in the center of a 12-in. circle. Spindle speed, 450 to 1,200 r.p.m. Height, 76 inches.

Toolmakers' Knee and Box Parallel, Precision
Simplex Tool Co., Woonsocket, R. I.
"American Machinist," February 9, 1922

The toolmakers' knee, adapted for gage and small work, may be used for both inspecting and laying out work either with or without a magnetic chuck and clamped directly to any surface. It is made in one size, 2½ x 3 x 4 in. The precision box parallel, for larger work than the ordinary parallel, is used in either the machine shop or toolroom for inspecting and laying out large work. It is made in four sizes from 4 x 4 x 6 to 6 x 14 x 16 inches.

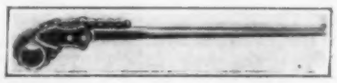


Press, Arbor, Garage, Hand-Operated
Evansville Arbor Press Co., Evansville, Ind.
"American Machinist," February 9, 1922

Presses Nos. 8 and 9, shown on the left, have stationary tables with 10-in. openings. The table on the Nos. 8-B and 9-B presses, shown at the right, consists of a pair of adjustable side bars. The uprights are channels 40-in. apart. A handwheel provides for quick return of the ram. Work diameter, No. 8, 30 in.; No. 9, 40 in. Largest arbor opening, 8 in. Capacity over table: No. 8, 27½ in.; No. 8-B, 36 in.; No. 9, 30 in.; No. 9-B, 44½ in. Weight: No. 8, 585 lb.; No. 8-B, 450 lb.; No. 9, 715 lb.; No. 9-B, 585 lb.

Wrench, Pipe, Chain
Armstrong Bros. Tool Co., Chicago, Ill.
"American Machinist," February 9, 1922

The wrench jaws are provided with long bearings on the bar, and with flanges to guide the chain and to protect it from abrasion. Two types of chain can be furnished, the flat-link style as shown, and the cable-link chain. The wrench is made in seven sizes, for use on pipe and fittings from ⅛ to 16 in. Wrench length, 20 to 78 in. Chain length, 13½ to 72 in. Weight 5½ to 98 lb.



Sand Blast, Portable, Hose-Type, Small Size
Pangborn Corporation, Hagerstown, Md.
"American Machinist," February 9, 1922

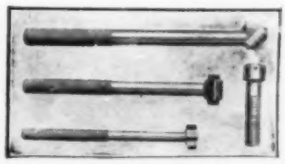
The hose machine consists of a suction-type gun controlled by a trigger in the handle. The motion of the compressed air carries the sand from the hopper to the gun body. The body forms a mixing chamber for the air and abrasive, giving it a swirling action. Nozzles are interchangeable. The blast operates on any air pressure from 5 to 100 lb. A small cabinet that can be set over the hopper of the hose sandblast, as illustrated, can be supplied for cleaning small parts.

Sawing Machine, Hack, Motor-Driven
Louisville Electric Mfg. Co., Louisville, Ky.
"American Machinist," February 9, 1922

The vise swivels and is graduated. The stroke length is adjustable from 5 to 7 in. Two speeds, 45 and 90 strokes per minute, are provided. Stock up to 5 in. thick can be cut. The feed is by gravity, and the saw arm can be raised and held in any position. An automatic stop shuts off the motor when the piece has been cut off. The motor has a capacity of ½ hp. and is fitted with ball bearings. The machine can be mounted on wheels. Floor space, 18 x 36 in. Height, 36 in. Weight, 450 lb.

Screwdriver, Offset, "Utility"
Porter Products Corporation, Brewerton, N. Y.
"American Machinist," February 9, 1922

The device is used in close quarters, being developed for automobile use. It operates with the handle at right angles to the screw. On each of the four sides of the head is a blade set at an angle of 45 deg. to the one on each side of it. The tool is rotated between each stroke to bring a different blade into use. Because of the leverage, large wood screws or machine screws can be easily set up, or screw bolts that have rusted in place can be loosened. The tool is made in three sizes, ¼, ⅜ and ½ in., the thickness of the blades being 0.040, 0.050 and 0.078 inch.



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Business Items

Beginning June first, the Arrow Tool and Manufacturing Co., of Bridgeport, Conn., will be known as the Forsberg Manufacturing Co. The change is being made because another company in the same field has a prior right to the name "Arrow."

The Modern Machine Tool Co., Jackson, Mich., has taken over the stock and machinery of the Sprague-Hayes Manufacturing Co.

The Reliance Steel and Tool Co., of New York, has moved its offices from 24 Murray St., to 30 Church Street.

The Spafford Machine Screw Works, Inc., of Hartford, Conn., has filed a voluntary petition in bankruptcy in the U. S. District Court at New Haven; showing liabilities of $40,638 and assets of $25,314.

Jenkins Bros., manufacturers of valves, etc., Bridgeport, Conn., following conferences with the workmen, decided to go on a five-day per week schedule. The company has been working six days, but in changing to the five-day schedule, the working hours will not be affected, as the new schedule will be arranged so as to get in the forty-eight hours per week.

The Remington Arms Co., Bridgeport, Conn., has recently incorporated under the laws of the State of Connecticut, as a separate corporation, the Remington Cutlery Works, to manufacture pocket cutlery, etc. The capital of the cutlery branch will be $25,000, and the incorporators are: Chauncey B. Garver, William B. Stitt and Charles R. Barrett, all of New York city. There will be no change in the management or policy of the company, and the new firm will be operated as a subsidiary of the larger concern. The knives will be manufactured in the Bridgeport plant.

The Hampden Grinding Wheel Co., of Springfield, Mass., has been incorporated under the laws of Massachusetts, to manufacture grinding wheels, etc. The firm will take over the present plant and business of the Hampden Corundum Wheel Co. in that city. The capital stock is $100,000 and the incorporators are Willard P. Leshure, John M. Collins and Frank S. Hatch. Mr. Leshure, who was president of the old company, will be the president of the new concern.

The Murmac Manufacturing Co., Inc., of Gloucester, Mass., has been incorporated under the laws of Massachusetts to conduct a general machine shop, etc. The capital stock of the new company is $25,000; the incorporators are John A. Moran, David F. Murphy and Morgan J. McSweeney, of 247 Essex St., all of Salem, Mass.

The Merwin Screw Co., Inc., Bridgeport, Conn., recently incorporated to manufacture and deal in screws, etc., has opened a shop at 143 Bennett St., that city. The company organized recently by the election of the following officers, who are also the directors: Fred H. Merwin, president and treasurer; N. A. Walsh, vice-president; Edna W. Merwin, secretary.

The Lomar Manufacturing Co., Middletown, Ohio, manufacturers of shock absorbers, has been incorporated with a capital stock of $100,000. Officers are: C. W. Shartle, Jr., president and general manager; Thomas Randolph, vice-president; L. L. Lomar, general superintendent.

The Murphy Valve Co., Columbus, Ohio, which was recently incorporated for $50,000, has elected Paul R. Good as president; Harry B. Redding, vice-president; Walter S. Jones, secretary; was William G. Jones, treasurer.

At the annual meeting of the stockholders of the Superior Sheet Steel Co., Canton, Ohio, the following officers were elected: W. W. Irwin, president; H. A. Roemer, vice-president and general manager; H. S. Renkert, treasurer; D. A. Williams, assistant general manager; M. C. Summers, general manager of sales; P. I. Howenstine, assistant treasurer; U. K. Becker, secretary.

Announcement has been made that the Blake Pump and Condenser Co., of Fitchburg, Mass., will locate in Alliance, Ohio, and perparations are now under way to move the machinery to that city. In the new location the concern will be known as the Alliance Pumping and Machinery Co.

The Ketchum Tool Equipment Co., L. Leroy Ketchum, president, 856 Broad St., Bridgeport, Conn., tool manufacturers, has recently filed a petition in bankruptcy in the United States District Court.

The Acme Machine Co., of Hartford, Conn., has filed a petition in bankruptcy in the United States District Court, giving liabilities of $67,151, and assets of $20,467.50.

The Wagner Electric Manufacturing Co., of St. Louis, Mo., announces the removal of its Salt Lake City office to 313 Dooly Building.

Personals

EARL CONSTANTINE, executive secretary of the National Industrial Council, has been appointed assistant to John E. Edgerton, president of the National Association of Manufacturers. He will be located at the headquarters of the association at 50 Church St., New York City.

FRANK HIGGINS, works manager of the Willys-Morrow plant in Elmira, N. Y., has left that position to engage in business for himself.

TOBIAS DANTZIG has resigned as research engineer of SKF Industries, Inc. He will engage in scientific and technical consulting work specializing in bearing problems.

O. H. DALLMAN, formerly of the Vanadium Alloy Steel Co., has joined the sales force of the Independent Pneumatic Tool Co., of Chicago. Mr. Dallman will travel out of the general offices in Chicago.

GEORGE W. WAY has joined the Detroit sales force of the Union Drawn Steel Co., of Beaver Falls, Pa. For several years he has been a specialty salesman for the Carnegie Steel Co. in the Michigan territory, leaving there to become general sales manager of the Cromwell Steel Co., of Cleveland. For the past year he has been in charge of sales in the Middle West for the Electric Alloy Steel Co. of Youngstown.

JOHN A. PEEBLES, general foreman of the Willys-Morrow plant in Elmira, N. Y., has resigned.

HENRY ROSS JONES, formerly president of the United Alloy Steel Corporation, of Canton, Ohio, has been elected chairman of board of directors of the fifteen million dollar Dominion Alloy Steel Co.

F. W. MURPHY has resigned as head of the highway products department of the Truscon Steel Co., Youngstown, Ohio. He has joined the sales force of the J. Ira Davey Co., of Detroit.

EDWARD T. MCNULTY has resigned as superintendent of the Yorkville, Ohio, plant of the Wheeling Steel Corporation to become general manager of the Charcoal Iron Products Co., at Washington, Pa.

GORHAM C. PARKER has organized the Parker Arbor Co., Ann Arbor, Mich., for the manufacture of the Parker drill chuck arbors.

EDWIN P. HOPFER, purchasing agent of the Hartford Specialty Machine Co., Hartford, Mass., has been appointed a member of the City Planning Commission of Hartford.

W. J. SMITH has been appointed special sales representative for Ohio and Michigan for the Hill & Griffith Co. of Cincinnati, Ohio.

A. H. BENNELL has resigned from the sales staff of the Youngstown Sheet and Tube Co., of Youngstown, Ohio.

F. N. SATTER has resigned as chief inspector with the Newton Steel Co., Newton Falls and Youngstown, Ohio, to become district sales manager of the Electric Alloy Steel Co., of Youngstown.

Obituary

A. W. GIBBS, chief mechanical engineer of the Pennsylvania Railroad system, died suddenly on May 19. He was 66 years old. He served as an apprentice in the Altoona, Pa., shops of the company in 1879.

WILLIAM YEATES, founder of the London Machine Tool Co., died last week at his home in London, Ont., Canada, following an illness extending over many months. He was 75 years old.

ISAAC JOSEPH, president of the Isaac Joseph Co., iron dealers, and of the Edna Brass Manufacturing Co., of Cincinnati, Ohio, died suddenly at his home in that city on May 23.

F. J. TOWN, superintendent of the foundry of the Pittsburgh Valve and Fitting Co., Pittsburgh, Pa., died at his home in Barberton, Ohio, on May 24. He was 69 years old.

Forthcoming Meetings

American Foundrymen's Association: Annual meeting, Rochester, N. Y., week of June 5. Secretary, C. E. Hoyt, 140 South Dearborn St., Chicago, Ill.

American Railway Association: Section III, Mechanical: Annual meeting, Atlantic City, June 14 to 21. (Formerly the Master Car Builders and the Association of Master Mechanics.)

Society of Automotive Engineers: Summer meeting, White Sulphur Springs, W. Va., June 20 to 24. C. F. Scott, 29 West 39th St., New York City, is chairman of the convention committee.

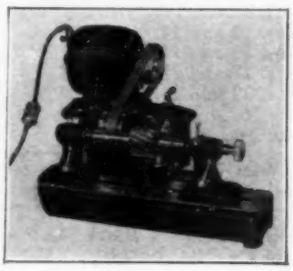
American Society for Testing Materials: Twenty-fifth annual meeting, Chalfonte-Haddon Hall Hotel, Atlantic City, June 26 to July 1. Secretary, C. L. Warwick, 1315 Spruce St., Philadelphia, Pa.

Condensed-Clipping Index of Equipment

Patented Aug. 20, 1918

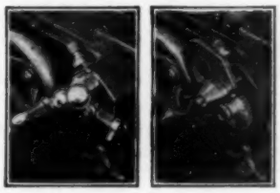
Grinding Machine, Cutter, Portable, Bench, "Elteco"
Liberty Tool Co., 1080 Springfield Ave., Irvington, N. J.
"American Machinist," February 9, 1922

The motor of ¼-hp. capacity can be driven by either direct or alternating current, and is mounted on a slide to adjust the tension of the wheel-spindle belt. The wheel head has a transverse movement of 4 in., obtained by a crank-operated screw. Straight grinding work is mounted on centers with a swing of 7 in. The maximum distance between the centers is 9 in. For grinding cutters with angles or tapers, an attachment is provided with a longitudinal movement of 1⅝ in. for feeding the work, the feed screw being operated by a crank.



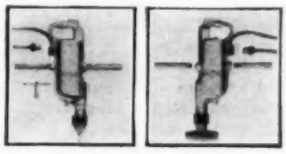
Stop, Cross-Slide, Lathe
Worcester Lathe Co., Worcester, Mass.
"American Machinist," February 9, 1922

A pinion keyed to the cross-feed screw is at all times in mesh with a gear which turns freely on a stud set into the back of the case. In adjacent faces of the gear and worm wheel are stop pins. The pins stop the rotation of the gear and worm wheel at a pre-determined point. The 0.001-in. graduations on the dial are spaced ¼ in. apart, for close adjustment. The stop is imposed against the rotation of the screw, instead of against the forward movement of the slide. The slide may be run forward or back, and returned by turning the lever to re-engage the stop pins.



Drill and Grinder, Electric, Portable, Combination
Wodack Electric Tool Corporation, 23 South Jefferson St., Chicago, Ill.
"American Machinist," February 16, 1922

The tool has a drilling capacity of ¼ to ⅝ in. in steel, and when used as a grinder carries a 6 x ¾ in. abrasive wheel. Two speeds are provided, the slow one for drilling, the fast one for grinding. The tool can be quickly changed from high to low speed and from grinding to drilling. The motor develops ½ hp. and is universal, for direct and alternating current with the same voltage. The switch, of the automatic-stop type, is located in the handle top. Weight, 19 lb.



Jack, Automobile, "Hi-Lift"
Weaver Manufacturing Co., Springfield, Ill.
"American Machinist," February 16, 1922

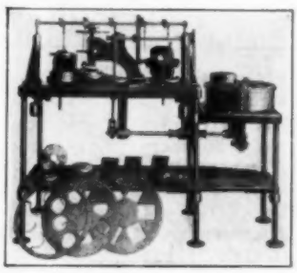
The jack is used in garages for lifting trucks and passenger cars, and enables the operator to raise one end of the chassis for working on the under parts of automobiles. The jack is mounted on four casters, the two near the operating lever having ball and roller bearings. The arm can be raised or lowered, by means of a ratchet and worm operated by a long lever. For raising and carrying truck wheels, an attachment can be fastened to the end of the arm. Saddle height, 7 to 38 in.; with screw attachment, 45 in. Lifting capacity, 3,000 lb. Width, 40 in. Weight, 225 pounds.

Prestometer, Fluid Gage, Piston-Ring
Coats Machine Tool Co., Inc., New York, N. Y.
"American Machinist," February 9, 1922

This device for gaging piston ring thickness consists of the prestometer fluid micrometer gage fitted to a special base. It has collapsible legs, and wing back stops to set the work. The base has two slots, extending radially at 60 deg. to each other from the point of contact of the measuring ball, to hold the adjustable contact points in position. It accommodates rings of any diameter up to 5 in. The piston ring rests on the two movable contact points and on the stationary one directly under the ball of the prestometer, giving a three-point support.

Finishing Machine, Air-Brake Valve, Semi-Automatic
Walter H. Foster Co., 50 Church St., New York, N. Y.
"American Machinist," February 16, 1922

The machine finishes mechanically both railroad air-brake slide valves and their seats, doing the lapping itself and maintaining flat surfaces to the edges of the ports and openings. The lapping plate and the work holder rotate in opposite directions, and are eccentric to each other. Thus, the work constantly changes its position on the lapping plate, so as to obtain flat surfaces and to keep the lapping plate true. The reciprocating laps on the left finish the seats in the bodies of the valves. A ½-hp. motor drives the machine, although tight and loose pulleys can be employed. Floor space, 64 x 28 in. Weight, 1,200 pounds.

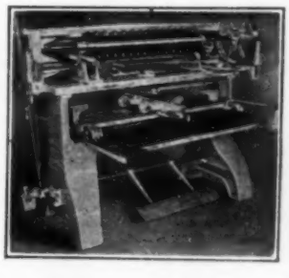


Sawing Machine, Band, Metal-Cutting
Clark Tool Works, Inc., Belmont, N. Y.
"American Machinist," February 16, 1922

The features of the machine are the movable carriage, gravity feed, work-holding vise and motor drive. The two speeds are controlled by a handle on the outside of the box. The table is pivoted in the center. The saw guides are mounted on the table and swing with it. The movable carriage operating on the table is provided with a gravity feed controlled by changing the position of the weight on the lever. Stops are provided to adjust the travel. The removable work-holding vise holds the work at any angle to the saw. Capacity, 6 x 12 in. Table, 20 x 24 in.

Marking Machine, Pantograph
George W. Dover, Inc., Providence, R. I.
"American Machinist," February 23, 1922

The machine is used for marking in multiple with diamond-pointed tools. The design or pattern is placed on the table at the front, and traced with the point connected to the pantograph motion operating the arm holding diamond-pointed tools. Thirty-four of these tools may be employed, and they cut both on the top and on the bottom of the work or roll. Lenses with trade marks invisible to the naked eye can also be marked. The top set of diamonds is rotated for this work by individual motors mounted on each spindle.



Clip, paste on 3 x 5-in. cards and file as desired

The Weekly Price Guide

Rise and Fall of Market

Advances.—Further upward movements in metals feature market, electrolytic copper quoted ½c. higher at New York; lead is now at 6.25c. higher than last week's price of 6c. Antimony is at 6.50c. Active demand has increased the price of copper sheets ½c. at New York, copper wire has advanced to 15c., and copper rods to 18.75c. Brass sheets and tubing rose from ¼ to ½c. Tin is firm. Zinc sheets are now quoted at 8.50c., advancing ½c. over last week's price. All scrap prices have advanced from ¼ to ½c., heavy brass now quoted at 7c.

Declines.—Linseed oil fell to 91c. from 95c. because of lack of demand. Solder has dropped 2c., from 23 to 21c.

IRON AND STEEL

PIG IRON—Per gross ton—Quotations compiled by The Matthew Addy Co.:

CINCINNATI	
No. 2 Southern	$25.52
Northern Basic	25.02
Southern Ohio No. 2	22.50
NEW YORK—Tidewater Delivery	
Southern No. 2 (Silicon 2.25 to 2.75)	28.56
BIRMINGHAM	
No. 2 Foundry	17.50
PHILADELPHIA	
Eastern Pa., No. 2x, 2.25-2.75 sil	26.36
Virginia No. 2	28.34
Basic	23.50@25.50
Grey Forge	25.00
CHICAGO	
No. 2 Foundry local	22.50@24.00
No. 2 Foundry, Southern, sil 2.25@2.75	24.17
PITTSBURGH, including freight charge from Valley	
No. 2 Foundry	24.16
Basic	25.00
Bessemer	26.96

IRON MACHINERY CASTINGS—In cents per pound:

	Light	Medium	Heavy
Pittsburgh	9.0	6.0	3.0
Philadelphia	8.5	5.0	3.0
Atlanta	5.5	4.5	4.0
Detroit	7.0	4.5	3.0
Birmingham	12.0	6.5	3.0
Denver	8.0	6.0	5.0
New Orleans	6.0	4.5	3.5
Minneapolis	9.0	6.0	4.5
New York	9@10	6.0	3.0
Cincinnati	6.0	5.0	4.5
Cleveland	6.75	4.5	2.6
Chicago	5.0	4.5	3.5

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the base quotations from mill:

Blue Annealed	Pittsburgh, Large Mill Lots	New York	Cleveland	Chicago
No. 10	2.40	3.48	3.15	3.38
No. 12	2.45	3.53	3.20	3.43
No. 14	2.50	3.58	3.25	3.48
No. 16	2.70	3.68	3.35	3.58
Black				
Nos. 17 and 21.	3.00	4.15	3.55	4.10
Nos. 22 and 24.	3.05	4.20	3.60	4.15
Nos. 25 and 26.	3.10	4.25	3.65	4.20
No. 28	3.15	4.35	3.90	4.30
Galvanized steel sheets:				
Nos. 10 and 11.	3.15	4.35	3.75	4.30
Nos. 12 and 14.	3.25	4.45	3.85	4.40
Nos. 17 and 21.	3.55	4.75	4.15	4.70
Nos. 22 and 24.	3.70	4.90	4.45	4.85
No. 26	3.85	5.05	4.60	5.00
No. 28	4.15	5.35	4.90	5.30

WROUGHT PIPE—The following discounts are to jobbers for carload lots on the latest Pittsburgh basing card:

Steel BUTT WELD Inches	Black	Galv.	Iron Inches	Black	Galv.
1 to 3	71	58½	⅜ to 1½	44½	29½
LAP WELD					
2	64	51½	2	39½	25½
2½ to 6	68	55½	2½ to 4	42½	29½
7 to 8	65	51½	4½ to 6	42½	29½
9 to 12	64	50½	7 to 12	40½	27½
BUTT WELD, EXTRA STRONG, PLAIN ENDS					
1 to 1½	69	57½	⅜ to 1½	44½	30½
2 to 3	70	58½			
LAP WELD, EXTRA STRONG, PLAIN ENDS					
2	62	50½	2	40½	27½
2½ to 4	66	54½	2½ to 4	43½	31½
4½ to 6	65	53½	4½ to 6	42½	30½
7 to 8	61	47½	7 to 8	35½	23½
9 to 12	55	41½	9 to 12	30½	18½

Malleable fittings. Classes B and C, Banded, from New York stock sell at net list. Cast iron, standard sizes, 20–5% off.

WROUGHT PIPE—Warehouse discounts as follows:

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv.
1 to 3 in. steel butt welded	66%	53%	60½%	47½%	62½%	48½%
2½ to 6 in. steel lap welded	61%	47%	58½%	44½%	59½%	45½%

Malleable fittings. Classes B and C, Banded, from New York stock sell at list less 10%. Cast iron, standard sizes, 32–5% off.

MISCELLANEOUS—Warehouse prices in cents per pound in 100-lb. lots:

	New York	Cleveland	Chicago
Open hearth spring steel (base)	4.00	6.00	4.50
Spring steel (light) (base)	8.00	6.00	6.00
Coppered Bessemer rods (base)	7.00	8.00	6.03
Hoop steel	3.38	2.81	3.13
Cold rolled strip steel	6.25	8.25	6.35
Floor plates	4.70	4.66	4.98
Cold finished shafting or screw	3.35	3.00	3.30
Cold finished flats, squares	3.85	3.50	3.80
Structural shapes (base)	2.58	2.41	2.38
Soft steel bars (base)	2.48	2.31	2.28
Soft steel bar shapes (base)	2.48	2.31	2.28
Soft steel bands (base)	2.98	....	2.88
Tank plates (base)	2.58	2.41	2.38
Bar iron (2.00@2.10 at mill)	2.48	2.21	2.28
Drill rod (from list)	55@60%	55%	50%
Electric welding wire:			
5/32	8.00		12@13
⅛	6.50		11@12
5/32 to ¼	6.25		10@11

METALS

Current Prices in Cents Per Pound

	New York	Cleveland	Chicago
Copper, electrolytic (up to carlots), New York			14.50
Tin, 5-ton lots, New York			32.25
Lead (up to carlots), St. Louis, 5.40; New York			6.25
Zinc (up to carlots), St. Louis, 5.27½; New York			5.62½@6.00
Aluminum, 98 to 99% ingots, 1-15 ton lots	19.20	20.00	18.00
Antimony (Chinese), ton spot	6.50	7.50	6.25
Copper sheets, base	20.25	20.00	23.00
Copper wire (carlots)	15.00	16.50	16.25
Copper rods (ton lots)	18.75	21.50	19.50
Copper tubing (100-lb. lots)	22.25	23.00	23.00
Brass sheets (100-lb. lots)	16.50	17.50	18.75
Brass tubing (100-lb. lots)	19.50	19.00	20.50

—Shop Materials and Supplies

METALS—Continued

Brass rods (1,000-lb. lots)	14.25	15.50	15.75
Brass wire (carlots)	17.00	17.75	.....
Zinc sheets (casks)	8.50	17.25	15.75
Nickel (ingot and shot), Bayonne, N. J.	36.00	.....	.....
Nickel (electrolytic), Bayonne, N. J.	39.00	.....	.....
Solder (½ and ½), (caselots)	21.00	22.00	19.00
Babbitt metal (fair grade)	35.00	40.75	36.00
Babbitt metal (commercial)	15.50	15.50	9.00

SPECIAL NICKEL AND ALLOYS—Price in cents per lb.

Malleable nickel ingots	45
Malleable nickel sheet bars	47
Hot rolled rods, Grades "A" and "C" (base)	50
Cold drawn rods, Grades "A" and "C" (base)	60
Copper nickel ingots	37
Hot rolled copper nickel rods (base)	45
Manganese nickel hot rolled (base) rods "D"—low manganese	54
Manganese nickel hot rolled (base) rods "D"—high manganese	57

Base price of monel metal in cents per lb., f.o.b. Bayonne, N. J.:

Shot	32.00	Hot rolled machined rods (base)	48.00
Blocks	32.00	Hot rolled rods (base)	40.00
Ingots	38.00	Cold drawn rods (base)	50.00
Sheet bars	40.00	Hot rolled sheets (base)	45.00

OLD METALS—Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Copper, heavy, and crucible	12.50	11.75	10.25
Copper, heavy, and wire	12.00	11.00	9.25
Copper, light, and bottoms	10.00	9.00	8.25
Lead, heavy	4.75	4.50	3.65
Lead, tea	4.25	3.25	3.00
Brass, heavy	7.00	5.00	8.00
Brass, light	6.00	4.50	4.75
No. 1 yellow brass turnings	6.50	5.50	5.00
Zinc	3.00	3.00	2.50

TIN PLATES—American Charcoal Plates—Bright—Cents per lb.

		New York	Cleveland	Chicago
"AAA" Charcoal Melyn Grade:				
IC,	20x28, 112 sheets	20.00	18.25	18.50
IX,	20x28, 112 sheets	23.00	21.00	20.90
"A" Charcoal Allaways Grade:				
IC,	20x28, 112 sheets	17.00	16.00	17.00
IX,	20x28, 112 sheets	20.00	18.75	19.60
Coke Plates, Bright				
Prime, 20x28 in.:				
100-lb.,	112 sheets	12.50	11.00	14.50
IC,	112 sheets	12.80	11.40	14.80
Terne Plate				
Small lots, 8-lb. Coating:				
100-lb.,	14x20	7.00	5.60	7.25
IC,	14x20	7.25	5.85	7.40

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb	$0.07½@$0.10	$0.12	$0.12
Cotton waste, mixed, per lb	.055@.09	.09	.09
Wiping cloths per M., 13½x13½	.....	50.00	55.00
Wiping cloths per M., 13½x20½	.....	55.00	65.00
Sal soda, 100 lb. lots	2.80	2.50	2.65
Roll sulphur, 360 lb. bbl., per 100 lb	2.85	3.25	3.50
Linseed oil, per gal., 5 bbl. lots	.91	.95	1.04
White lead, dry or in oil	100 lb. kegs.	New York, 12.25	
Red lead, dry	100 lb. kegs.	New York, 12.25	
Red lead, in oil	100 lb. kegs.	New York, 13.75	
Fire clay, per 75 lb. bag		.80	1.00
Coke, prompt furnace, Connellsville	per net ton	$3.25@$3.50	
Coke, prompt foundry, Connellsville	per net ton	$4.25@$4.75	

SHOP SUPPLIES

Current Discounts from Standard Lists

	New York	Cleveland	Chicago
Machine Bolts:			
All sizes up to 1x30 in.	60–10%	60–10%	60%
1½ and 1¼x3 in. up to 12 in.	60%	60-10-10%	60-10%
With cold punched sq. nuts	40%	.....	....
With hot pressed hex. nuts up to 1x30 in. (plus std. extra of 10%)	45%	.....	$4.00 off
Button head bolts, with hex. nuts	30%	$3.90 net	.....
Hex. head and hex. nut bolts	35%	.....	65-5%
Lag screws, coach screws	60–5%	.....	60-5%
Square and hex. head cap screws	75–10%	75%	70-10%
Carriage bolts, up to 1 in. x 30 in.	45%	60%	50–5%
Bolt ends, with hot pressed nuts	55%	.....	55%
Tap bolts, hex. heads	+10–15%	.....	.....
Semi-finished nuts ⅝ and larger	70%	75–5%	80%
Case-hardened nuts	65%	.....	.....
Washers, cast iron, ⅛ in., per 100 lb. (net)	$5.00	$3.50	$3.50
Washers, cast iron, ⅜ in. per 100 lb. (net)	5.00	3.50	3.50
Washers, round plate, per 100 lb. Off list	5.00	....	3.50 net
Nuts, hot pressed, sq., per 100 lb. Off list	3.25	3.50	4.00
Nuts, hot pressed, hex., per 100 lb. Off list	3.25	3.50	4.00
Nuts, cold punched, sq., per 100 lb. Off list	3.25	3.50	4.00
Nuts, cold punched, hex., per 100 lb. Off list	3.25	3.50	4.00
Rivets:			
Rivets, 7/8 in. dia. and smaller	60-10%	70%	60-10%
Rivets, tinned	60-10%	70%	4½c. net
Button heads ⅜-in., ½-in., 1x2 in. to 5 in., per 100 lb (net)	$3.70	$3.25	$3.00
Cone heads, ditto (net)	3.80	3.35	3.10
1½ to 1½-in. long, all diameters, *EXTRA* per 100 lb	0.25	.....	0.15
⅜ in. diameter *EXTRA*	0.15	.....	0.15
½ in. diameter *EXTRA*	0.50	.....	0.50
1 in. long, and shorter *EXTRA*	0.50	.....	0.50
Longer than 5 in. *EXTRA*	0.25	.....	0.25
Less than 200 lb. *EXTRA*	0.50	.....	0.50
Countersunk heads *EXTRA*	0.35	.....	$3.35 base
Copper rivets	60–5%	50%	50-10%
Copper burs	40%	50%	.....
Lard cutting oil (50 gal. bbl.) per gal.	$0.65	$0.50	$0.67½
Machine oil, lubricating, (50 gal. bbl.) per gal.	0.45	0.35	0.40
Belting—Present discounts from list in fair quantities (½ doz. rolls)			
Leather:			
Light grade	50%	50–5%	60–10%
Medium grade	40–5%	40–10–2½%	50%
Heavy grade	35%	40%	40–5%
Rubber and duck:			
First grade	60–5%	50–10%	40 10%
Second grade	60–10–5%	60–5%	60–5%
Abrasive materials—In sheets 9x11 in.:			
No. 1 grade, per ream of 480 sheets, Flint paper	$5.84	$3.85	$6.48
Emery paper	8.80	11.00	8.80
Emery cloth	27.84	32.75	29.48
Flint cloth, regular weight, width 3½ in., No. 1 grade, per 50 yd. roll,	4.50	.....	4.95
Emery discs, 6 in. dia., No. 1 grade, per 100.			
Paper	1.32	.....	1.49
Cloth	3.02	.....	3.20

New and Enlarged Shops

Machine Tools Wanted

Ill., Chicago—Levitan Mfg. Co., 1335 Washington Blvd.—one hand screw machine with 1¼ in. hole in spindle.

Kan., Hutchinson—The Modern Welding & Machine Shop, North Adams St., M. W. Hartman, Mgr.—heel cylinder grinding machine.

La., New Orleans—R. R. Hepinstall & Co., Maison Blanche Annex—12 ft. plate bending roll for ½ in. plate.

Mich., Battle Creek—Nichols & Shepard Co.—10 ft. power brake for 10 gage iron.

Mo., Carterville—Carterville Garage, 324 West Main St., R. Rice, Purch. Agt.—power drill press, lathe and emery wheel.

Mo., Carterville—W. Wilson, 120 East Main St., (garage)—power lathe, drill press and electric motor, 60 cycle.

Mo., Carthage—C. W. Biggs, (woodworking and machine shop)—lathe for power equipment.

Mo., Carthage—Carthage Press, H. K. Steward, Purch. Agt.—one power metal cutting machine and a power drill press.

Mo., Carthage—W. C. Hoots, 317 East 4th St., (woodworking shop)—wood lathe, band saw and polishing machinery for power equipment.

Mo., Joplin—Zark Dehydration Co., 1801 Main St., manufacturer of fruit dryers—power riveting machine for sheet metal.

Mo., Kansas City—H. C. Darnell Mchy. Co., 15th and Elmwood Sts.—power lathe, shaper and drill press.

N. Y., Beaver Falls—J. P. Lewis Co., (paper manufacturer), H. S. Lewis, Purch. Agt.—roll-grinding equipment.

N. Y., Brooklyn—U. S. Indestructible Gasket Co., 829 East 15th St.—one multiple four spindle movable drill head, to drill four holes 1/8 to 7/8 in. diameter, equally spaced on circles from about 3 to 6 in. diameter.

N. Y., Buffalo—A. Plotkin, 72-74 East Eagle St.—machinery and equipment for garage and repair shop.

N. Y., Niagara Falls—The McGarigle Machine Co., 518 2nd St.—cylinder grinding machine.

N. Y., Rochester—Morley Machine Corp., 800 St. Paul St.—lathes, punch presses and boiler tubes.

N. Y., Rochester—L. A. Royal, 4 Church St.—one 10 x 15 or 12 x 18 Platen press, (new or used).

N. Y., Rochester—C. Weber, Andrews St.—cylinder grinder and small machinery and tools for proposed garage on North Water St.

O., Cincinnati—The Eastern Mchy. Co., 408 East Pearl St., R. Smith, Purch. Agt.—power punch presses, all sizes, No. 18, 19, 20 and 21 Bliss; boring mills 30-72 in.; radial drills; 24 in. shaper; lathes 10, 12 and 14 in. swing; lathes 24-60 in. swing; hand screw machine.

O., Cincinnati—A. A. McLaughlin & Co., 24 West 2nd St., (dealers in woodworking machinery)—one Hawker No. 2 dowel machine; one Am. Columbia 42 in. and 48 in. triple drum sander; Smith or Greenlee hollow chisel mortiser; automatic lathe, 10 ft. between centers, 6 in. swing; Bates or Wysong & Miles, belt sander, (used).

O., Cincinnati—Norton-Broadway Mchy. Co., 236 Bway., (dealers in used machinery)—one 6 ft. radial drill press and one 36 in. shaper.

O., Cincinnati—The Randle Mchy. Co., Cincinnati, Hamilton & Dayton R.R. and Powers St.—60 in. vertical boring mill and power shear for 6 in. x 6 in. x ½ in. angles, (used).

O., Columbus — The Murphy Valve Co., Majestic Theatre Bldg., W. S. Jones, Secy.—one boring machine, one grinder, one drill press and other equipment.

O., Columbus—R. J. Rickenbocker, 183 East Cherry St., garage and repair shop—one grinder, one drill press and other equipment.

Pa., Sheffield—C. A. Dahl—machinery and equipment for garage and blacksmith shops now under construction.

Pa., Sheffield—M. A. Olson—cylinder grinding machine and other machinery for garage now under construction.

Va., Big Stone Gap—The Lonesome Pine Motor Co., (automobile repairs), A. P. Hammond, Secy.—various small tools in connection with machine shop.

Wis., Milwaukee—The Automotive Grinding Co., 118 Clinton St.—one Heald grinder No. 65.

H. T., Honolulu—The Honolulu Rapid Transit Co., Ltd., H. S. Johnson, Mgr.—$13,000 worth of machine and car shop equipment.

Ont., Ottawa—The City of Ottawa, City Hall, F. H. Plant, Mayor—cement gun, Universal tool and cutter grinder, power press, single head bolt machine, variety saw, quarry jack hammer, buzz planer and matcher, oil and gas furnace, and scleroscope.

Ont., Welland—The Lackawanna Tubes, Ltd., F. L. McCallum, Purch. Agt.—
One 18 x 10 lathe.
One 20 in. shaper.
One 36 in. planer.
One 20 in. drill press.
One 14 in. emery wheel and stand complete.
Blacksmith outfit.
One hydraulic pump 1,500 lb. pressure, 2,000 lb. max.
One air compressor 100 lb. pressure, and receiver for same.
One Gillitine billet shear for 4 in. max. round-inlet table 20 ft. long with gauges.

Machinery Wanted

Del., Wilmington—J. E. Marsden Glass Wks., Inc.—machinery and equipment for glass manufacturing plant.

Ga., Atlanta—The Atlanta Casket Co., Box 693, N. P. Cannon, Pres.—machinery and equipment for steel casket plant now under construction.

Ga., Cuthbert—Randolph County Advertising Club, J. G. Woodruff, County agt.—15-ton ice plant, complete.

Ky., Jackson—Jackson Lumber & Supply Co., W. C. Cole, Mgr.—machinery and equipment for lumber mill.

Ky., Lexington—American Metallic Packing Co.—225 cu.yd. daily capacity, jawed portable rock crusher on skids or wheels, (used).

Miss., Laurel—Chamber of Commerce, W. H. Smith, Secy.-Mgr.—complete machinery and equipment for canning plant.

Mo., Carterville — Carterville Weekly News, O. L. Whitestine, Purch. Agt.—job press and newspaper press for new plant.

Mo., Carthage—F. E. Ford, 313 East 4th St., (woodworking shop)—wood lathe, polishing machinery, and sanding machinery, for power equipment.

Mo., Carthage—G. W. Gibboth, 315 East 5th St., (blacksmith shop)—power drill press.

Mo., Kansas—Cavanal Coal Co. Ridge Bldg.—10-ton ice plant.

Mo., Kansas City—V. L. Phillips Co., 700 Delaware St., (contractor)—rock crusher, mounted outfit, but can use small jaw crusher on skids.

Mo., Webb City—Hilburn & Plain, F. Plain, Purch. Agt. — newspaper power printing press and job press.

N. Y., Batavia—E. N. Rowell Co., Inc.—additional machinery for the manufacture of paper boxes.

N. Y., Batavia—Ralph Gypsum Co. — crushing and screening machinery and equipment for mine.

N. Y., Buffalo—Amer. Macaroni Co., Inc., 825 Ferry St.—machinery and equipment for proposed macaroni factory.

N. Y., Buffalo—The Buffalo Coffee Co., Inc., c/o W. J. Daetsch, Ellicott Sq.—coffee roasting and packing machinery.

N. Y., Buffalo—Woodworking Mchy. Co. of Buffalo, 54 Mechanic St.—miscellaneous woodworking machinery.

N. Y., Jamestown—The New Ice & Coal Co., Gokey Bldg., J. H. Rogerson, Purch. Agt.—machinery for handling coal, wood, etc., and for the manufacture of ice.

N. Y., North Tonawanda—R. Wurlitzer Co., Inc., Niagara Falls Blvd.—machinery and equipment for the manufacture of toys.

N. Y., Rochester—M. Brennan, Frank St.—air compressor, pump and other equipment for proposed service station on Jones and Brown Sts.

N. C., Marion—The Clinchfield Pottery Wks., A. W. Hilton, owner—machinery for the manufacture of pots, vases and various earthenware articles.

O., Cleveland—Cleveland Metal Products Co.—machinery for the manufacture of oil stoves and utensils, for proposed plant at Oakland, Cal.

O., Cleveland—Nat. Bronze & Aluminum Fdry. Co., East 88th St. and Laisy Ave—molding machines and miscellaneous foundry equipment.

Pa., Greenville—The Du Roth Steel Truck Co.—machinery for proposed truck factory.

Pa., Greenville—Greenville Steel Car Co.—one 10-ton crane.

Pa., Marianville—The Marianville Express, E. Pickens, Purch. Agt.—printing press, printshop equipment and small machinery to replace presses, etc., destroyed by fire.

Pa., Phila.—The Pennsylvania R.R., 18th and Filbert Sts., c/o Purchasing Dept.—6-15 ton electric cranes, 97 ft. span, for proposed addition to car shops at Altoona.

Pa., Pittsburgh—Bd. Educ., Fulton Bldg.—woodworking machinery for manual training departemnts of Westinghouse High School and Perrysville and Greenfield Elementary Schools, now under construction.

Pa., Republic—Redstone Twp. Bd. Educ., c/o A. Thompson, Republic—equipment for manual training dept. of high school in Redstone Twp., near Uniontown.

Pa., Titusville—E. Moore, 321 South Franklin St.—complete tinsmithers outfit and tools.

Pa., Titusville—Titusville Iron Wks. Co.—machinery and tools for proposed foundry on South Perry St.

S. D., Chamberlain—J. H. Olson & Co.—motor and mortise and tenon machine.

Tex., Austin—The Woodward Mfg. Co., Post Rd., S. Sparkes, Vice-Pres.—machinery for proposed auto body factory.

Va., Berkley (Norfolk P. O.) — The Huddleston Mahogany Co. Inc., c/o Greenleaf Johnson Lumber Co., S. Moore, Secy.—woodworking machinery.

Va., Gloucester—The Roaring Springs Marl Lime Co., R. M. Janney, Mgr.—several hoisting engines for plant, (new or used).

Va., Ocean View—The Normandie Corp., Willoughby Beach Blvd., bottling plant, C. A. Anderson, Secy.—bottling machinery for soft drink plant at Norfolk.

W. Va., Bluefield—Amicon Fruit Co., H. Charlton, Vice-Pres. and Genl. Mgr.—machinery for cold storage plant addition.

Wis., Fox Lake—F. N. Pettigrew—machinery for proposed truck factory at Waupun.

Wis., Milwaukee—H. Becker, 3407 Center St.—refrigeration machinery, motor power.

Wis., Milwaukee—C. Bielefeld, 1161 Grant St., carpenter and millwork—one sander.

Wis., Milwaukee—Maple Leaf Dairy Co., c/o W. G. Wheeler, 204 Grand Ave.—dairy plant equipment, line shaft drive.

Wis., Milwaukee—North American Textile Corp., c/o G. W. Kalinert, 1392 Prospect Ave.—looms, looping machines and electric motors.

Wis., Milwaukee—J. Weiss, 301 Reed St. —woodworking machinery to manufacture show cases, (exact requirements not determined).

Wis., Racine—The Wisconsin Gas & Electric Co., 305 6th St., S. B. Sherman, Purch. Agt.—one mono rail crane.

Wis., Riplinger—The Cheesemakers Mfg. Co., B. F. Riplinger, Purch. Agt.—modern cheese-making machinery, power.

Wis., Wisconsin Rapids—The Eighth Corner Cheese Factory, c/o A. Whitrock, Route 5—cheese making machinery, vats and boiler.

Mexico, Mexico City—The San Raefel Paper Co., Ltd.—machinery and equipment for proposed paper mill at Merida, Yucatan, Mex.

Ont., Burnt River—J. Hadley—equipment for shingle mill recently destroyed by fire.

Ont., Galt—Newlands & Co., Ainslie St. —weaving machines, etc., for robe and woolen mill addition.

Ont., Kitchener—Kitchener Mfg. Co., S. F. Howard, Mgr.—materials, tools and machinery for the manufacture of radio outfits.

Ont., Lynden—R. A. Thompson—$25,000 worth of equipment for flour mill.

Ont., Niagara Falls—The Canadian Shredded Wheat Co.—machinery for the manufacture of shredded wheat.

Ont., Toronto—B. Amod, 1216 St. Clair Ave.—gasoline pump and tank for garage.

Ont., Welland—British Empire Cutlery Corp., Ltd., C. Grantham, Purch. Agt.—machinery for the manufacture of scissors.

Ont., Welland—The St. Thomas Packing Co., W. Moody, Mgr.—complete equipment for cold storage plant.

Metal Working Shops

Cal., Colma—M. Massaglia has awarded the contract for the construction of a 1 story machine shop, on San Bruno Ave. Estimated cost $10,550.

Cal., San Francisco—E. T. Meakin, c/o Powers & Ahnden, Archts., 460 Montgomery St., is having plans prepared for the construction of a machine shop on Folsom and 14th Sts. Estimated cost $20,000.

Cal., Vallejo—Western Die Casting Co., 2927 Newbury St., Berkeley, is receiving bids for the construction of a 1 story 125 x 162 ft. factory on Napa St., here. C. E. Perry, Jr., 514 Marin St., Archt.

Conn., Springdale—The Segal Metal Products Co. has awarded the contract for the construction of a 1 story 40 x 45 ft. foundry extension, and a 3 story 30 x 120 ft. machine shop.

Ill., Chicago—R. F. France, Archt., 155 North Clark St., is receiving bids for the construction of a 1 story, 110 x 200 ft. garage at 247-78 North Clark St., for K. R. Beak Co., 193 North Clark St. Estimated cost $40,000.

Ill., Chicago—The Fries-Malwitz Motor Co., 4001 Irving Park Blvd., is having plans prepared for the construction of a 2 story, 122 x 217 ft. auto sales and service building on Irving Park Blvd. near Keeler Ave. Estimated cost $300,000. J. Jensen, 4915 North Lawndale Ave., Archt.

Ill., Chicago—The Holton-Seeley Co., 140 South Dearborn St., is receiving bids for the construction of a 2 story, 125 x 161 ft. garage at 616-24 Dewey Pl. Estimated cost $50,000. L. E. Russell, 25 North Dearborn St., Archt.

Mass., Cambridge—The Simplex Wire & Cable Co. has awarded the contract for the construction of an addition to its factory. Estimated cost $100,000.

Neb., Lincoln—F. W. Tyler, 827 "N" St., plans to build a 1 story, 50 x 50 ft. shop for plumbing and heating machine work. Estimated cost $8,000.

N. Y., Binghamton—Titchener Iron Wks., Inc., plans to construct additions to its plant at 7 Frederick St. Estimated cost between $35,000 and $40,000. L. E. Barnes, Secy.

N. Y., Buffalo—The Buffalo General Electric Co., 960 Front St., plans to construct 120 x 120 ft. service building 45 ft. high, on Front St. Estimated cost $135,000. Architect not announced.

N. Y., Buffalo—Fedders Mfg. Co., Inc., 57 Tonawanda St., manufacturer of auto radiators, plans to build a specialty factory addition to its plant. Estimated cost $5,500.

N. Y., Buffalo—J. Emig & Son, 871 East Ferry St., manufacturer of special machine tools, dies, etc., has awarded the contract for the construction of a 1 story, 50 x 80 ft. machine shop. Estimated cost $5,000.

N. Y., Buffalo—L. Reimann, 69 North Division St., plans to build a machine shop addition. Estimated cost $5,000. Architect not announced.

N. Y., Buffalo—E. M. Statler Co. plans to build a 6 story garage on Delaware Ave. and Mohawk St. Estimated cost $300,000 to $350,000.

N. Y., Geneva—De Zeng Standard Co., East State and 20th St., Camden, N. J., plans to build a factory for the manufacture of optical instruments, on East Main St., here. Estimated cost between $40,000 and $50,000.

N. Y., Hammondsport—The Keuka Industries Inc., plans to rebuild part of machine shop recently destroyed by fire. Estimated cost between $20,000 and $25,000. J. H. McNamara, Genl. Mgr.

N. Y., North Tonawanda—The Frontier Mfg. Co. plans to rebuild portion of kettle factory on Erie Ave., which was destroyed by fire. Estimated cost $20,000. Architect not announced.

O., Warren—The Youngstown Steel Co., Stambaugh Bldg., Youngstown, plans to build a large steel plant at Gibbons Farm, off North Mahoning Ave., here. Estimated cost $100,000 to $150,000. Architect not announced.

Pa., Bellefonte—Western Penitentiary of Pennsylvania, is having plans prepared for the construction of a 1 story, 30 x 132 ft. machine shop at Rockview. J. Frances, Warden. Private plans.

Pa., Greenville—The Du Roth Steel Truck Co. is receiving bids for the construction of a steel truck factory on Osgood St. Estimated cost $50,000. Architect not announced.

Pa., Newton Falls—The Newton Steel Co. is having plans prepared for the construction of 6 new sheet mills. $750,000. Architect not announced.

Tex., Austin—The Woodward Mfg. Co., Post Rd., manufacturer of auto bodies, plans to rebuild its plant which was destroyed by tornado. Estimated cost $200,000. S. Sparks, Vice-Pres.

Wis., Mellon—Universal Toy & Novelty Mfg. Co. plans to build a 1 story 100 x 152 ft. factory. Estimated cost $40,000. J. R. and E. J. Law, Strand Theatre Bldg., Madison, Archts.

Wis., Waupun—F. N. Pettigrew, Fox Lake, plans to build a 2 story, 70 x 120 factory here, for the manufacture of trucks. Estimated cost $50,000. Architect not selected.

Ont., Toronto—B. Amode, 1216 St. Clair Ave., has awarded the contract for the construction of a 1 story 50 x 60 ft. garage on Yonge St. Estimated cost $15,000.

General Manufacturing

Cal., San Francisco—California Woodcarving Co., 144 8th St., has awarded the contract for the construction of a 2 story, 27 x 100 ft. wood carving shop on Southeast Howard and Langton Sts. Estimated cost $15,000. Private plans.

Cal., San Francisco—The Italian-Amer. Cigar Co., 419 Jackson St., is having plans prepared for the construction of a 4 story factory on Vallejo and Battery Sts. Estimated cost $160,000. I. Zanolini, 604 Montgomery St., Archt.

Conn., Hanover—The Airlie Mills has awarded the contract for the construction of a 2 story, 60 x 230 ft. addition, for the manufacture of woolen goods. Estimated cost $85,000.

Conn., Hartford—The Capitol City Glass Co., Chapel St., has awarded the contract for the construction of a 2 story, 40 x 150 ft. addition to its glass factory. Estimated cost $40,000.

Ky., Jackson—Jackson Lumber & Supply Co., plans to build a lumber mill to replace the one destroyed by fire. Estimated cost $130,000. W. C. Cole, Mgr.

Ky., Lexington—The Co-operative Dairy Co. plans to construct a dairy on Jefferson St. $11,000. Architect not announced.

Me., Lewiston—Bates Mfg. Co. plans to build an addition to its mill for the manufacture of gingham goods. Architect not announced.

Mass., Springfield — The Springfield Catholic Diocese, Eliott St., has awarded the contract for the construction of a 1 story 40 x 180 ft. laundry on Wilbraham Rd. Estimated cost $40,000.

Mich., Kalamazoo—The Kalamazoo Vegetable Parchment Co., River Bd., is having plans prepared for the construction of a 4 story addition to its paper mill. Estimated cost $500,000. Billingham & Cobb, Press Blk., Archts.

Mich., Sault Ste. Marie — The Cadillac Lumber & Chemical Co., is having plans prepared for the construction of a 1 story, 93 x 275 and 110 x 110 ft., saw mill. Estimated cost $250,000. E. C. Hall, 221 Grand Ave., Milwaukee, Wis., Archt.

Minn., South St. Paul—R. N. Katz Packing Co., 352 East 6th St., St. Paul, is having plans prepared for the construction of a 3 story, 50 x 130 ft. packing plant, and a 1 story, 34 x 36 ft. office building. Estimated cost $100,000. Henschien & McLaren, 37 West Van Buren St., Chicago, Archts.

Minn., Winona—The Pepin Packing Co. is having plans prepared for the construction of a 1 story, 72 x 180 ft. canning factory and storage warehouse. Estimated cost $50,000. A. H. Husemann, 614 9th Ave., W., Archt.

Mo., Kansas City—F. C. Sharon, Sterling Bldg., will soon award the contract for the construction of a 1 story, 50 x 150 ft. factory for the manufacture of cartridges, on the northeast corner of Belmont and Independence Sts. Private plans.

N. J., Nutley—G. La Monte & Sons Co. Kingsland Rd., has awarded the contract for the construction of a 1 story, 60 x 100 ft. paper factory and a 2 story, 60 x 80 ft. office building. Estimated cost, $60,000.

N. Y., Batavia—K. B. Mathes, c/o Uni-Lak Co., manufacturer of paint specialties, plans to build a 1 story factory on South Lyon St. Estimated cost $25,000. Architect not announced.

N. Y., Buffalo—Amer. Macaroni Co., Inc., 825 Ferry St., plans to build a factory for the manufacture of macaroni. Estimated cost $5,200.

N. Y., Buffalo—Queen City Candy Co., Inc., 396 Bway., plans to build a 22 x 76 ft. candy factory addition, 26 ft. high. Estimated cost, $5,000. Architect not announced.

N. Y., Newark—Phillips-Werth Optical Co., Rochester, is receiving bids for the construction of a 55 x 175 ft. optical factory on Willow Ave. and West Main St., here. Private plans.

N. Y., New York—The New York Times, Times Sq., will soon receive bids for the construction of an 11 story, 100 x 143 ft. printing plant and office building at 217 West 43rd St. Ludlow & Peabody, 101 Park Ave., Archts. Noted Jan. 19.

N. Y., New York—The Transit Commission, 49 Lafayette St., will receive bids until June 5, for the construction of additional shops at Lenox Ave. and 148th St. Private plans.

N. Y., Port Henry—The Witherbee-Sherman Co. have had plans prepared for the construction of extensive additions to present plant facilities, including new blast furnace, daily capacity 500 ton, and new sintering plant capacity 400 tons, etc.

N. Y., Rochester—The Duntile Products Co., Holland, Mich., plans to construct tile manufacturing plant on Lexington Ave., here. Estimated cost between $40,000 and $50,000.

N. Y., Rochester—The Rochester Gas & Electric Corp., Clinton Ave, N., plans to

construct and install a new liquid gas pumping station. Estimated cost $70,000. J. P. Haftenknapp, Engr.

N. Y., Utica—The McLoughlin Textile Corp., plans to build a factory and warehouse at 614 Broad St. Estimated cost $40,000 to $50,000.

N. Y., Watertown—The International Burr Corp., 500 Newell St., plans to construct a factory for the manufacture of pulp stone dressing burrs. Estimated cost between $20,000 and 25,000. Adress W. P. Aiken, c/o owner.

N. Y., Waverly—The Philadelphia Battery Co. is having plans prepared for the construction of a 3 story, battery manufacturing, charging, repairing and storage plant on Fulton. Estimated cost between $40,000 and $45,000. C. W. Smith, Waverly, Archt.

N. C., Goldsboro—The Utility Mfg. Co. plans to rebuild its veneering plant which was recently destroyed by fire. Estimated loss $200,000. Architect not selected.

N. C., Mt. Pleasant—A. M. Haithcock is having plans prepared to construct a flour mill. Estimated cost, $10,000 to $12,000.

N. C., Shelby—A. P. Weathers, et. al., plan to construct a cold storage plant. Estimated cost, including machinery and equipment, $40,000. Architect not selected.

O., Canton—The Hygienic Products Co., 715 Walnut Ave., S. E., has had plans prepared for the construction of a 2 story, 50 x 70 ft. factory for the manufacture of cleasing powder. Lockwood, Greene & Co., Hanna Bldg., Cleveland, Archts.

O., Cleveland—A. and B. Box Co., 8628 Woodland Ave., has awarded the contract for the construction of a 1 story, 90 x 193 ft. factory, at 1190 East 152nd St. Estimated cost $60,000. H. C. Roberts, Secy.

O., Cleveland—Billings-Chapin Co., 1163 East 40th St., is receiving bids for the construction of a 4 story, 80 x 140 ft. factory, for the manufacture of paints, on East 40th St. along the tracks of the New York Central R.R. Estimated cost $200,000. Lockwood Green & Co., Hanna Bldg., Archts.

O., Cleveland—Kaase Co., 2836 Lorain Ave., plans to build a 2 story 150 x 200 ft. addition to its bakery. Estimated cost $100,000. C. Kaase, Pres. W. D. Guion, 640 Engineers Bldg., Archt.

O., Cleveland—The Standard Envelope Co., 1011 Oregon Ave., is having plans prepared for the construction of a 1 story factory. Estimated cost $60,000. Christian, Schwartzenberg & Gaede, 1900 Euclid Ave., Archts.

O., Cleveland—H. M. White Music Co., 5229 Superior Ave., has awarded the contract for the construction of a 3 story 30 x 115 ft. factory on East 53rd St. and Superior Ave. Estimated cost $50,000. H. M. White, Pres.

O., Wellsville—The McNicol-Corns Pottery Co. plans to rebuild part of its pottery plant recently destroyed by fire. Estimated cost $8,500.

Pa., Altoona—The Confederated Home Abbatoir Corp., 216 Commerce Bldg., will receive bids until May 29, for the construction of 4 story, 81 x 163 ft. meat packing plant, 2 story, 47 x 57 ft. stock pens and 40 x 60 ft. power plant, on Sugar Run Rd. Estimated cost $125,000. Gorman-Brown Eng. Co., Boston, Mass., Archts. C. Stadler, 49 Rector St., New York, Engr. Noted Feb. 9.

Pa., Lewistown—The Viscose Co., Marcus Hook, manufacturer of artificial silk, has awarded the contract for the construction of 1 story manufacturing buildings, here. Estimated cost $1,500,000.

Pa., Marianville—The Marianville Glass Mfg. Co. plans to rebuild its plant which was recently destroyed by fire. Estimated cost $55,000. Architect not announced.

Pa., Phila.—W. E. S. Dyer, Engr., Land Title Bldg., is receiving bids for the construction of a 5 story, 61 x 64 ft. plush factory on Venice St. and Green Lane, for the Kaufman Plush Co. Estimated cost $80,000.

Pa., Phila.—G. W. Lindsay, 5120 Wakefield St., has awarded the contract for the construction of a 2 story, 40 x 100 ft. machine shop addition at 5116 Wakefield St.

In May

we published

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Machine-Tool and Machinery Wanted Items

which is at the rate of over 6000 items a year, against 2277 items published in the whole of 1921.

In addition

we printed 253 tips as to new and enlarged metal-working shops and general manufacturing plants.

American Machinist

offers the best machinery market in America

Are you making the most of it?

Pa., Phila.—The Quaker City Laundry, 48th and Ludlow Sts., has awarded the contract for the construction of a 2 story, 16 x 32 ft. laundry on 48th and Ludlow Sts. Estimated cost $85,000.

Pa., Wissinoming (Phila. P. O.)—C. Wunder, Archt., 1415 Locust St., Phila., is receiving bids for the construction of 2 story, 35 x 50 ft. and 1 story, 48 x 234 ft. factory for the Natl. Ammonia Co., Van Kirk Ave., Phila. Estimated cost $50,000.

R. I., Olneyville—The Rochambeau Worsted Co. has awarded the contract for the construction of a 3 story, 100 x 300 ft. factory for the manufacture of worsted goods. Estimated cost $250,000.

Vt., Brattleboro—The Preshey-Leeland Co., Barre, plans to construct granite cutting plant. Estimated cost $100,000. Architect not announced.

Va., Richmond—Virginia Carolina Rubber Co., 10 North 19th St., plans to build a 1 story, 100 x 271 ft. factory on Mill Rd. along the tracks of the Southern R.R. Estimated cost $25,000. Davis Bros., 2510 West Main St., Archts.

Va., West Point—Chesapeake Corp. of West Point, plans to build a mill for the manufacture of pulp board and paper specialties. Estimated cost $200,000 to $250,000. W. C. Gouldman, Secy. Architect not selected.

W. Va., Bluefield—Amer. Fruit Co. plans to build a 6 story cold storage plant addition. Estimated cost including machinery, etc., $250,000. H. Charlton, Vice Pres. and Genl. Mgr. Architect not announced.

Wis., Madison—Kennedy Dairy Co., 618 University Ave., will soon award the contract for the construction of a 2 story, 85 x 132 ft. dairy. Estimated cost $80,000. E. Tough, 24 East Mifflin St., Archt.

Wis., Madison—The Natl. Vacuum Street Sweeper Co., c/o D. Mowry, Secy. Assn. of Commerce, Cantwell Bldg., plans to construct a 4 story, 60 x 120 ft. factory. Estimated cost $60,000. Architect not selected.

Wis., Madison—M. P. Schneider, Archt., 401 West Doty St., is receiving bids for the construction of a 1 story, 50 x 110 ft., filling station on Gilman St., here, for North Wisconsin Oil Co., Menasha. Estimated cost $45,000.

Wis., Monroe—The Badger Cheese Co. has awarded the contract for the construction of a 2 story, 26 x 100 ft., cold storage plant. Estimated cost $25,000.

Wis., Prairie du Chien—The Prairie du Chien Woolen Mill Co., has awarded the contract for the construction of a 3 story 47 x 186 ft. factory addition. Estimated cost $65,000.

Wis., Pulaski—The Badger Cabinet Co., Plymouth, plans to construct a 2 story, 50 x 100 ft., furniture factory. Estimated cost $55,000. Architect not selected.

Wis., Racine—S. C. Johnson & Son Co., 1012 16th St., manufacturer of floors, etc., has awarded the contract for the construction of a 3 story, 60 x 162 ft. factory on 15th St. Estimated cost $70,000.

Wis., Spencer—The Spencer Condensory Co. has awarded the contract for the construction of a 2 story, 48 x 96 ft. condensory. Estimated cost $30,000. Noted March 2.

Ont., Burnt River—J. Hadley plans to rebuild shingle mill recently destroyed by fire. Estimated cost $35,000.

Ont., Galt—Newlands & Co., Ainslie St., will soon award the contract for the construction of a 3 story, 86 x 86 ft. factory addition for the manufacture of robes and woolens. Estimated cost $50,000. Address G. Dobbie.

Ont., Niagara Falls—The Canadian Shredded Wheat Co. has awarded the contract for the construction of a storage building, containing a cleaning department, etc., on Lewis Ave. Estimated cost $150,000.

Ont., Welland—The Empire Cotton Co., Ltd., A. D. Payne, Secy.—machinery and equipment for new $250,000 addition to cotton mill here.

Ont., Windsor—The Shell Oil Co., 3608 Notre Dame St., E., Montreal, is having plans prepared for the construction of an oil distributing plant on Caron Ave., here. Estimated cost $100,000. Private plans.